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ANNOUNCEMENT

Mr. J. W. Barbour has joined the staff of the Railway Periodicals Company, Inc., as Western manager with headquarters in the Old Colony Building at Chicago. Since 1909 Mr. Barbour has been associated with the sales department of the Armstrong Brothers Tool Company, representing them in various parts of the country. During the past four years he has been their Eastern representative. He has thus come in close contact with railroad officials and railroad supply manufacturers, and has a wide acquaintance among them.

From 1903 to 1907 he was with the Illinois Steel Company, being employed in the mechanical and production departments. He later became connected with the Elgin, Joliet & Eastern Railroad. He was in their employ for two years before joining the Armstrong Brothers Tool Company.

INCIDENTAL STRAINS OF CONSTRUCTION

During the construction of the Hell Gate Arch Bridge, which forms the connection from the Bronx to the Borough of Queens in the New York Connecting Railway, one of the details of the operation which might be overlooked in contemplating the completed arch, was the detailing of two corps of engineers with all proper instruments and facilities for measuring the daily increasing deflections resulting from the strains involved in the structure as it progressed day by day.

The bridge, now, since completion of the arch, is self-sustaining and self-contained—and the strains existing, while great on account of the unprecedented size of the bridge, can be calculated without undue difficulty and can be properly met.

On account of the difficult bottom encountered and the strong and varying tidal currents prevailing in the Hell Gate, it was not considered feasible to support the bridge during its construction with the usual false work. It was decided to build the arch out from opposite sides over the water, as two great arms which, when they met in the center, would form halves of the final arch and be mutually supporting.

These arms were, during the progress of their construction, to all intents and purposes, built as cantilevers. Just before the final or Keystone members were set in place, two great arms were hung out over the water, supported by tension back stays—over a saddle above the permanent abutments, to counter weights. It will readily be seen that the strains in the structure during this process differed vitally from the strains in the completed arch.

These construction strains, as they might be called, were carefully determined and the deflections that would result, day by day, as the weight of the arms was increased and given more leverage, were also noted.

It was these daily increasing deflections which were measured by the detailed engineers, and compared with the deflections expected from the calculations. Had variations occurred which could not readily have been reconciled with the plans—an opportunity would have been afforded to halt operations before the elastic limit of the unduly strained members had been reached and a remedy sought for, and applied.

Such close attention to the strains incident to construction as the work progressed day by day might have gone far to prevent some of the accidents which have marred the erection of such structures as the Laurier Bridge at Quebec, a few years past.

More notice is being given in these days to what might be called incidental strains of construction and there can be no doubt that this is one of the determining causes of the reduction of accidents of erection with their accompanying loss of life—of material—and often of the reputation of the designers.

TRANSCONTINENTAL RAILWAYS AND THE CANAL

In the last annual report of the Atchison, Topeka and Santa Fe Railway Company the Panama Canal is referred to as a serious competitor, and the loss to the Atchison by reason of this is estimated at more than a million dollars for the year. The question naturally arises, will the Panama Canal, in time, be a serious menace to the transcontinental railroads or will it result in a benefit? In the growth of a city or a country competition in transportation facilities has always resulted, in the end, in a benefit not only to the sections served but to the transportation companies at the same time.

When the elevated railroads in New York City were projected there was a noisy hue and cry on the part of the owners of the street surface railroads that their business would be ruined. They saw bankruptcy staring them in the face and began preparations, forthwith, to meet an appalling collapse. Behold! a new and splendid era was dawning instead. The completion of the elevated lines was the making of the surface railroads. Business immediately increased, and extensions uptown and under the elevated roads soon became necessary to meet the requirements. The elevated system had started a growth of the city which was beyond all conception. The move uptown was something stupendous. Vacant streets running north and side streets to the east and west were soon building up and where goats had browsed and rubbish had accumulated a new city was rapidly developing. No moving picture, however thrilling, could have caught the eye and attention as this scene did.

Those who travelled uptown by the elevated got off here and there and patronized the street lines coming back. Local travel on the surface increased by leaps and bounds, and while the elevated lines surprised the projectors who had built them by the enormous business they created, the surface lines also enjoyed an unexpected prosperity. The elevated roads were exactly what the city needed to develop its growth. As a result, everything in the way of traction facilities was in demand, and, as the city grew, all became grossly inadequate. The great public were crying for more service, and they badly needed it. All this proved to be a wonderful exhibition of what competition can produce. It settled this momentous question in the city of New York for all time, and so long as New York exists the cry for more facilities will be heard; more subways, more tunnels, more street railroads to carry the annually increasing population. New York is only an example of what this great country is now and always will be crying for.

After the "trolleys" were launched, with their rapid service in suburban districts, and towns after towns became united by the introduction of electricity, the owners of the steam railroads, alongside of which this apparently threatening competitor found its way, became panic stricken lest they be forever ruined. So, with what they supposed was clever judgment, they set out to buy them up in order to control the situation. They assumed debts and other obligations beyond measure in their haste to save themselves. Most of these guarantees were wasted, as we know. Never was a more foolish policy than this ever adopted. The trolleys would have brought them new business any way, both directly and indirectly. Never would a pound of freight have been lost nor a passenger gone astray. Though competitors at heart, they, in reality were feeders and without the control which was purchased at enormous cost the "trolleys" would have been much more faithful allies than a corps of travelling freight agents or an army of active passenger representatives. None can better appreciate this to-day than the determined purchasers of these suburban electric lines of the past 15 years. The Panama Canal, in the long run, will stand for the same results. Its apparently threatening competition will be metamorphosed into a great business producer for the railroads which now belt the country. The Pacific coast towns will have a renewed impetus when the canal is in thorough working order. As they grow and become prosperous new business both by land and sea will be developed. Directly and indirectly the canal competition will be a boon to the railroads instead of a menace. Much of the freight destined for points inland from the Pacific, which will of necessity seek the water route, will be business for the railroads which they might never have secured had it not been for the canal. As to passenger traffic, that will be of moment as time goes on. Out, one way, and back the other, long after the novelty shall have worn off, will be the itinerary of thousands upon thousands of pleasure seekers and business men as well.

Passenger business, by the way, is usually regarded by railroad managers as an expensive luxury; one of those necessary attachments to the service which, as a rule, results in a loss. Viewed, however, from all standpoints this is, assuredly, a wrong conception of it, for the country and the towns built up by the people who travel and settle here and there produce a limitless amount of business in the way of freight directly and indirectly as well as mail and express matter which is a source of large profit eventually. It would seem that to encourage passenger traffic is a wise rather than an unwise measure.

This great country is on the verge of the grandest development that could be imagined, and the Panama Canal will be one of the stable means to aid in this direction. The next decade will bring about unusual conditions, while the railroads and the people will all be benefited beyond measure. Great public improvements which seek to encourage the distribution of commodities and people never fail to produce lasting and substantial results.

THE RAILWAY MAIL SERVICE

The Merchants' Association of New York have carefully considered the subject of compensation to the railroads for carrying the mails and find that the raidroads are greatly underpaid by the government. The exhaustive investigation made by the Railway Business Association resulted in the same conclusion, and between the two, in the interests of the railroads, a substantial increase in allowances for handling the mails is likely to be brought about. It is needless to dwell upon the importance of this.

The Merchants' Association have concluded that the so-called Bourne and Moon bills now before Congress would divert a large amount of merchandise traffic from the railroads and unjustly. The investigation was made by a special committee who directed its whole attention to the subject of postal affairs and they found:

That the railroads are grossly underpaid for carrying the mails; that there is no profit in carrying the mails at the present rates; that the compensaion for this service has been reduced 50 per cent. in the last thirteen years; that the new plan of payment proposed by the Postoffice Department would compel further reductions; that the U. S. Government pays for postal freight carried on passenger trains only one-third what the merchants of the country pay for merchandise carried on freight trains and that with the extension of the parcel post, freight is now diverted from all the railroads and that their freight revenues are very seriously threatened.

With these findings as a basis, this committee recommends:

That the Merchants' Association of New York oppose any and all bills for the readjustment of railway mail pay on the plan proposed by the Bourne and Moon bills. That the association advocate: payment, for the present, to cover weight on the basis of the existing law; but with a provision for annual instead of quadrennial weighings. Also, payment for apartment car space, pro rata upon the basis of payment now in effect for full postal cars, as well as payment for side and transfer services or, as an alternative, that the railroads be relieved of the performance of these services; and, finally, that for not less than two years, all weighings and adjustments for determining railway mail pay be supervised by the Interstate Commerce Commission which shall obtain from the Postoffice Department and the railroads reports covering all necessary information as to the service performed and thereafter report to Congress, with recommendations as to further changes, if any, that should be made in the law.

The findings of this committee are quite in line with the facts and are therefore reasonable, while the recommendations proposed are extremely proper. This whole matter should be pressed to a satisfactory conclusion, relieving the railroads from the present unjust burden and permitting them for the future to enjoy reasonable returns for their services. The Merchants' Association have certainly been engaged in a public spirited direction.

RAILWAY BLOCK AND TOBOGGAN SLIDE

One of the fundamental conceptions in the art of railway signaling is to introduce the principle of a space interval between trains, rather than use the more or less uncertain time interval. The space interval implies that a train should not be approached by a following train nearer than a certain specified distance without notice. This is safe, but it is still possible for two trains to get close to each other if one had just stopped on entering a block, and a following train had run up to the end of the preceding block.

In order to prevent accident in automatic signaling each signal post carries two semaphore blades. One is the "home" signal and the other is the "distant." The home signal guards the entrance to the block in front of which it stands, while the distant signal reproduces the indication given by the home signal on the block next behind. In this way if the home signal permits entrance to its block, the distant signal will show the condition of that block. If therefore a train has halted just after entering a block, the home signal behind it would show "stop," and the distant signal would repeat the indication. A following train entering the preceding block, "cautioned" by the distant signal, would receive the information that the block next ahead was occupied, and it must therefore be prepared to stop.

A fairly good illustration of the use of the space interval may be drawn from the winter sport known as tobogganing. On any well conducted "slide," such as that maintained by a club, there is at a certain distance from the starting point, a mark of some kind set up to indicate what is considered the safety space intervals. In Canada this is often a small fir tree stuck in the snow bank beside the slide and at night a torch is kept burning at this point.

The rule which must be observed, and which introduces the space interval as a measure of safety, is that no toboggan shall leave the starting point until the toboggan going down the slide has passed the point marked by the fir tree or the "distance light."

This is not a system which is absolutely safe, as a toboggan may have passed the distance point and subsequently have fouled the toboggan track; but it, at least, prevent a thoughtless rush of merrymakers from starting so close together that their different speeds would bring about interference, if not accident. The system, even with its crudity of execution, nevertheless has in it the safety principle of the space interval.

If it was possible to make the distance mark repeat its indication at the starting point, and also to carry an indication of the condition of the section of the slide beyond, it would be a closer approximation to the signals used on railways. The automatic signals are not concerned with the speed of the trains any more than the distance mark is with that of the various toboggans on the slide. The slide mark holds the "block" between it and the starting point, as occupied until the party gliding down the icy incline of the slide has passed beyond the mark and has sped on. The distance point is usually selected at or near the base of the steepest incline of the slide, so that the toboggan will presumably be at maximum speed at that point and the safety of the party be assured, as far as may be, from the danger of a rear collision.

"Fininshing" means in art simply "telling more truth," and what we have in any sort begun wisely, it is good to finish thoroughly.—*Modern Painters.*

Best virtues are shown in fighting faults.—*The Ethics of the Dust.*

The Tunkhannock Viaduct on the D. L. & W.

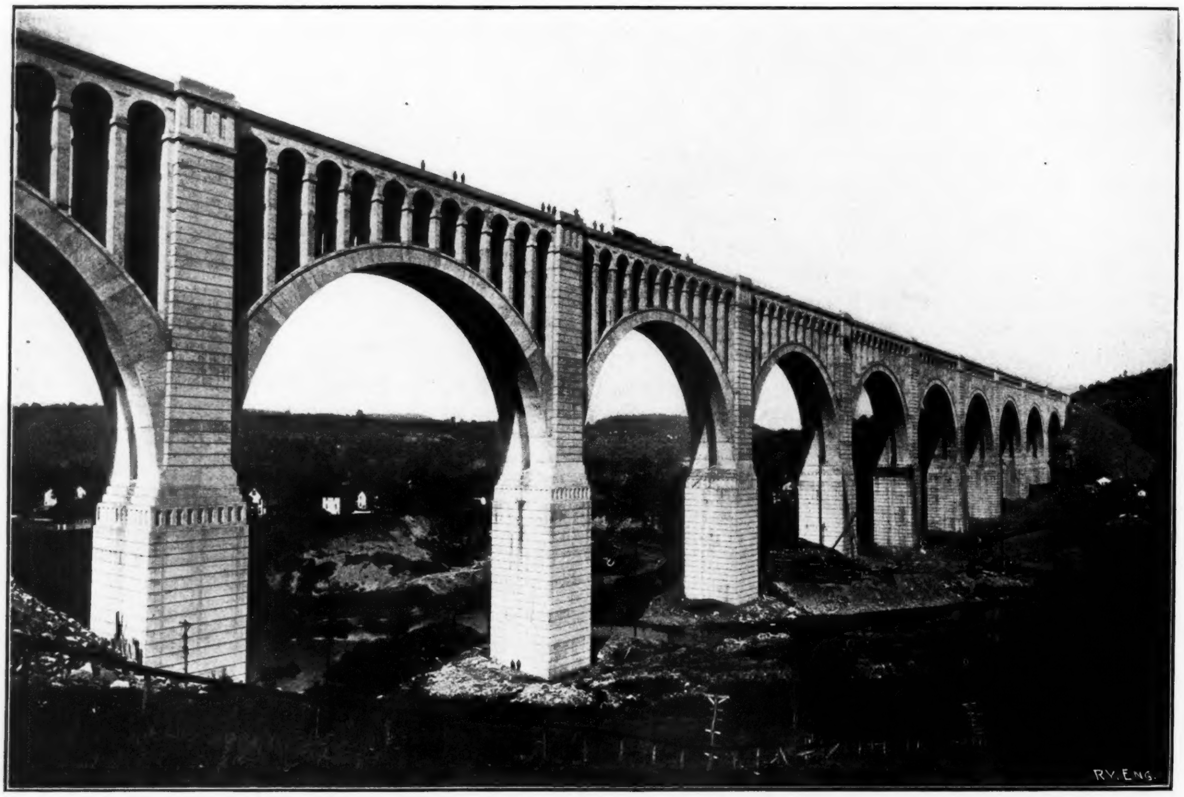
One of the biggest railroad engineering works in this country will be put into active use on Nov. 7th, 1915. The Lackawanna Railroad will begin on that date to send regular passenger trains over the new "cut-off" between Clark's Summit and Hallstead, Pa. The cut-off is 39.6 miles in length and means a saving of 3.6 miles between New York and Buffalo. The opening of this new double track road will reduce the distance to 396 miles.

By taking a short-cut from Clark's Summit, seven miles west of Scranton, to Hallstead, about fourteen miles east of Binghamton, N. Y., a maximum grade of 1.23 per cent. was cut to .68 per cent. Formerly the total curvature was 3970 degs. On the new cut-off it amounts to only 1570 degs. In modern operation of trains this means that the new cut-off will pay for itself many times over, though the cost of the cut-off is estimated at about twelve millions. The 3.6 miles in the new line will reduce the running time on passenger trains about twenty minutes, while freight trains will save an hour. In other words, freight trains which formerly required five engines can, on the new cut-off be moved at the same rate of speed by two.

The Tunkhannock Viaduct, on which the new line is carried over Tunkhannock Valley, is an imposing structure. If the Flatiron Building in New York were continued on up Broadway from 23d street to 32d street, filling the street from building line to building line, it would represent a structure of just about the same size and dimensions as this viaduct. The concrete arches which carry trains high above the earth are graceful in outline and form. This viaduct is by several times the largest concrete bridge in the world. Half a mile long and 240 ft. high, it is more than 100 ft. higher than the roadway of the Brooklyn Bridge. It consists of ten spans of 180 ft. each and two spans of 100 ft. each. It contains approximately 4,509,000 cb. ft. of concrete, and 2,280,000 lbs. of re-enforcing steel. The railroad tracks are enclosed between massive parapet walls 3 ft. thick and rising above the track to a height of 4 ft., thus insuring safety without interfering with the magnificent view from train windows. All of the foundations were carried to solid rock. Two of the piers required an excavation of 95 ft. in depth, while the excavation for the piers in the bottom of the valley was carried through sand, gravel and boulders to a depth of 60 ft. below the water level.

It is what railroad men know as a replacement line, being for the most part in sight of the old line for which it is substituted. The radical reduction of grades and curves is achieved by very heavy cutting and filling and by viaducts of large size. Some idea of the magnitude of the operation is seen from the fact that the amount of earth moved reached a total of 5,525,000 cb. yds., while the rock excavation amounted to 7,647,000 cb. yds., 8,100,000 cb. ft. of concrete were used, and the amount of re-enforcing steel employed in the various bridges, viaducts and culverts amounted to 4,720,000 lbs.

The Lackawanna cut-off is so notable an example of



Tunkhannock Viaduct on the Lackawanna Railroad Company's new 39-mile Scranton-Binghamton Cut-off. This viaduct is half a mile long and as high as a 20-story building.

modern railroad construction that several foreign governments had arranged to send over their representatives on tours of inspection, and were only prevented from so doing by the general European war.

The new work begins near Clark's Summit Station, the new line crossing the old twice at a grade which is 29 ft. below the old, at the Station. The cut at this point is about two miles long and from 20 to 60 ft. deep. Near the north end of the cut, the new line swings away from the old one, reaching a maximum divergence of about 1½ miles near Factoryville, and then returns to within a few hundred feet at Nicholson. The line between Clark's Summit and Nicholson, cutting across the natural drainage of the land at right angles, requires numerous cuts and fills, many exceeding 100 ft. in depth.

After leaving the station and high bridge at Clark's Summit, the traveler approaches the village of Glenburn with its concrete station, red tile roof and its sanitary white glazed tile interior. Just beyond the Casey cut lies Dalton, where from a fill 115 ft. in height the traveler may obtain a panoramic view of Waverly on the right and Dalton on the left. The station at Dalton of vitrified brick with its tile roof, modern and artistic, is typical of the stations along the cut-off. Spaces are left in the concrete platforms for flower beds, and the switch board in the wall, for electric light equipment.

Before reaching La Plume, one may observe the bridge over the Mortimer Fallon private road, and the open-construction Slayton arch with its re-enforced floor and concrete supporting arch. The artistic, graceful lines of these structures, typical of the many concrete bridges, arches and viaducts along the cut-off, plainly indicate that beauty as well as permanence and utility is a factor in modern railroad construction. The station at La Plume is constructed of field stone and its red tile roof affords a particularly effective contrast with the green of the surrounding landscape. Next follows an equally artistic station at Factoryville, built of concrete with a brick veneer up to the windows.

The south branch of Tunkhannock Creek which the traveler now approaches is reached by an embankment 140 ft. high, requiring 1,600,,000 cb. yds. of material. This embankment is over 2,000 ft. in length and from its summit may be seen the surrounding country with five mountains visible in the distance.

The divide between the north and south branches of this creek is passed in a double track tunnel 3,630 ft. long with approach cuts aggregating 27,000,000 cb. ft. of excavation. This tunnel, the only one on the cut-off, is 600 ft. shorter than the Bergen Hill Tunnel. It has two 135-foot ventilating shafts lined with concrete, while the rest of the tunnel is lined with brick.

Just west of the Tunkhannock Viaduct, the traveler, after leaving the station at Nicholson, passes into Martin's Creek Valley. Here the new line runs to the east of the old line, which it crosses by means of the Martin's Creek viaduct shortly after leaving Foster, and about one mile east of the brick station of Kingsley with its green tile roof. The Martin's Creek viaduct, while not so large as the Tunkhannock, is 150 ft. above the bed of the stream, and 88 ft. above the old line grade. It consists of 11 spans, 7 of 150 ft., 2 of 100 ft., and 2 of 50 ft., having a total length over all of 1,600 ft., 2,092,500 cb. ft. of concrete were used in its construction and 1,600,000 lbs. of re-enforcing steel. Less than half the size of the Tunkhannock viaduct, the Martin's Creek viaduct is itself, with the single exception of the Tunkhannock viaduct, the largect concrete viaduct that we know of.

A few miles west of Kingsley is the artistic little station of Alford. It is built of brick with green tile roof and artificial conglomerate stone trimming of yellow and white pebbles.

Martin's Creek Valley is very narrow with steep and irregular slopes requiring heavy work to keep within the standard of curvature, which is 2 degs. wherever possible, with a maximum of 3 degs. in only three instances.

From New Milford to Hallstead the work is much lighter, the improvement ending about two miles north of the Hallstead Station. The entire work of building this cut-off was planned and executed by Mr. George J. Ray, chief engineer of the railway. Mr. F. L. Wheaton was chief engineer of construction in immediate charge of the work. The Tunkhannock viaduct was built under the personal supervision of Mr. F. M. Talbot.

INTERNATIONAL ENGINEERING CONGRESS AT SAN FRANCISCO

Papers read at the International Engineering Congress held in San Francisco, California, September 20-25, which are of special interest to readers of RAILWAY ENGINEERING, included:

"Mechanical considerations controlling and governing the building of new railroad lines" by John F. Stevens, who pointed out the conditions peculiar to the U. S. that have influenced the development of our present railway systems. He elaborated on the idea that with the rapid growth of the country, the development of trunk lines, while comparatively rapid and haphazard, was now sufficiently complete to make the next problems concern branch lines and terminals. It is his impression that railroad projects of the future in this country should receive much more careful and conservative consideration before construction commences than has been the prevailing practice heretofore. He makes a plea for the establishment of low ruling grades and maximum rates of curvature and believes in the elimination of pusher grades, and in constructing work permanently, in the first place.

"The locating of a new line," presented by William Hood, chief engineer, Southern Pacific, dealt with the designing of the grade system and locating the center line of a proposed road whose terminals have been fixed. He discussed the temporary use of sharp curves to reduce first cost of construction and the co-ordination of grades to reduce the number of classes of locomotives required. Easement of curves, field work in locating the line, compensation of grades on curves and the comparison of alternative roads were considered.

"Tunnels," a paper presented by Chas. S. Churchhill, assistant to the president of the Norfolk & Western, summarizes the structural features of the most important tunnels recently or soon to be completed in America. Most of these have already received more or less consideration in the engineering periodicals of this country. Snoqualmie tunnel, on the Chicago, Milwaukee & St. Paul in the Cascade Mountains, completed in January, 1915, is single track and slightly over 2¼ miles long. This tunnel has been cut through hard rock and is lined with concrete. The Sandy Ridge tunnel on an extension of the Carolina, Clinchfield & Ohio, is single track, about 1½ miles long, and was driven through soft stone and slate and lined with concrete after the tunnel was opened for traffic. The Nicholson tunnel on the Delaware, Lackawanna & Western, double track, 3,600 ft. long, was driven through soft rock, clay and gravel and required full timber throughout. The Mt. Royal tunnel at Montreal and the Seattle tunnel were given as types

of tunnels used in gaining ready access to important terminals. The Rogers Pass tunnel on the Canadian Pacific in the Selkirk Mountains, which is now under construction using the pioneer drift method, will be the longest tunnel in North America.

"The Reconstruction of the Panama Railroad," presented by Fred Mears of the Alaska Engineering Commission, discussed the two divisions of the work of reconstructing the Panama Railroad. The first part of the work included putting in order the old French line, following closely its original location and in addition to extensive passing tracks and yards 37 miles were double-tracked. After this was accomplished an entirely new railroad was built on a new location in order to raise the line above the water level of lakes along the route and to pass around Gold Hill, and avoid the Gaillard cut. Embankments cross arms of Gatun Lake involving 5,000 cu. yds. of fill. Two large bridges over the Chagres and Gatun Rivers were built and a tunnel 636 ft. long was required at Miraflores.

"Railway construction methods and equipment," by William G. Sloan, chief engineer, McArthur Brothers Co.. New York, taking up the various elements of railway construction as practiced in this country under present condition, by clearing and grubbing, handling material from excavation into embankments, tunneling, bridge construction, track laying, ballasting and the construction of miscellaneous structures.

"Track and road bed," presented by George H. Pegram, chief engineer of the Interborough Rapid Transit Co., New York City, discussed the problems of both steam and electric lines in present American practice, and paid special attention to the conditions, with which he is most familiar, governing electric lines having exceptionally heavy high-speed traffic.

"American railroad bridges," by J. E. Greiner, consulting engineer of the Baltimore & Ohio Railroad, discussed the evolution of American railroad bridges in three historical divisions. The first division which closed with 1865 included bridges largely of temporary construction, in which the designers were governed almost entirely by their personal judgment. In the second period, extending to 1890, scientific design became the rule, and the pin-connected steel truss was developed. The third period which includes the present time is characterized by increase in train loads requiring heavier structures, and increased speed, requiring stiffer structures. New materials including modern structural steel and recently alloyed and special steel and reinforced concrete have had their influence. Examples of modern tendencies in bridge construction were cited and the Cooper wheel loading was discussed as well as the practice of anticipating in the building of a bridge all possible increase in rolling loads during the natural life of the bridge.

"Signals and interlocking," by Charles Hansel, reviewed the development of the automatic block system, going into detail in regard to the development of alternating current systems and mentioning the adoption of upper quadrant semaphore indication. Automatic train control was included in his subject and brought out some discussion.

"Preservative treatment of timber," by Howard F. Weiss, director of the Forest Products Laboratory, and Clyde H. Teesdale, in charge of wood preservation, Forest Products Laboratory, Madison, Wisconsin, described in a general review the methods and results obtained in the United States in the preservation of timber. The author discussed both the extent to which this practice was being used and the extent of the increase in length of life afforded by the various methods of treatment.

NEW APPARATUS FOR DETERMINING THE FINENESS OF CEMENT

During the past three years experiments carried on by the Bureau of Standards have resulted in developing an apparatus which is effective in determining the exact fineness of cement by separating a given sample into the proportions it contains of each varied degree of fineness.

It has long been known that the fineness to which the cement is ground is one of its most important characteristics, and consequently specifications require that 75 per cent. or more of commercial cement shall pass through a No. 200 sieve, which has 40,000 openings per sq. in. This is the practical limit of mechanical sieves in respect to fineness.

It is very important to have some means of measuring directly the entire state of subdivision of cement; in other words, to discover just what percentage of the material is made up of particles of certain definite sizes. If such a division can be made, it should be possible not only to compare the efficiency of different grinders, but also to determine what degree of fineness must be attained before the cement becomes "hydraulically active"—that is, capable of combining with water to form the binding material in mortar and concrete.

The apparatus devised by the Bureau of Standards consists of a vertical brass pipe, about 3 ins. in diameter and 5 ft. long, at the lower end of which is attached a glass bulb in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and as the air can escape only through the vertical stack it carries with it the cement dust, which is caught in a flannel hood surmounting the stack. The air flow in the stack is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. This residue is weighed and the amount of dust is determined by subtracting the weight of the residue from that of the original sample of cement. Different grades are obtained by using different-sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standarized without reference to the size of the nozzles and other parts of the apparatus or the air pressure used.

It is found that the cement "flour"—that is, the portion of cement which contains no perceptible grit when rubbed between the fingers—consists of particles less than 0.0007 in. in diameter. The apparatus is called the air analyzer, and may be used for separating and grading any hard-grained materials, such as ground quartz, emery, and other abrasives. The air analyzer in modified form is also capable of separating many other powders, for example, paint pigments, plasters, clays, and similar materials.

Copies of Technologic Paper No. 48, the publication upon this subject, may be obtained, without charge, upon application to the Bureau of Standards, Washington, D. C.

INTERESTING INFORMATION

The New Haven Railroad Co. is making records for safety and generally good management very rapidly. In the first six months of the year 1915, according to recent reports, no passenger was killed in a train accident. Nearly 13,000 signal tests were made during the same period and the results showed 99.75 per cent as perfect. In the first six months of 1914, 32 employes were killed in the service, compared with 22 in the first six months of the present year. The showings in every respect on the New Haven are most excellent.

Double Rail Track Circuit Using Alternating Current

The slow but steady improvement in our means of using the noiseless but potent force of electricity has brought with it many surprises and many notable achievements. It may be said that perhaps one of the latest forms in which the electrical engineer's success has been marked, is in the use of alternating current for driving railway trains, and at the same time using alternating current for operating the signals, and using both rails for each current.

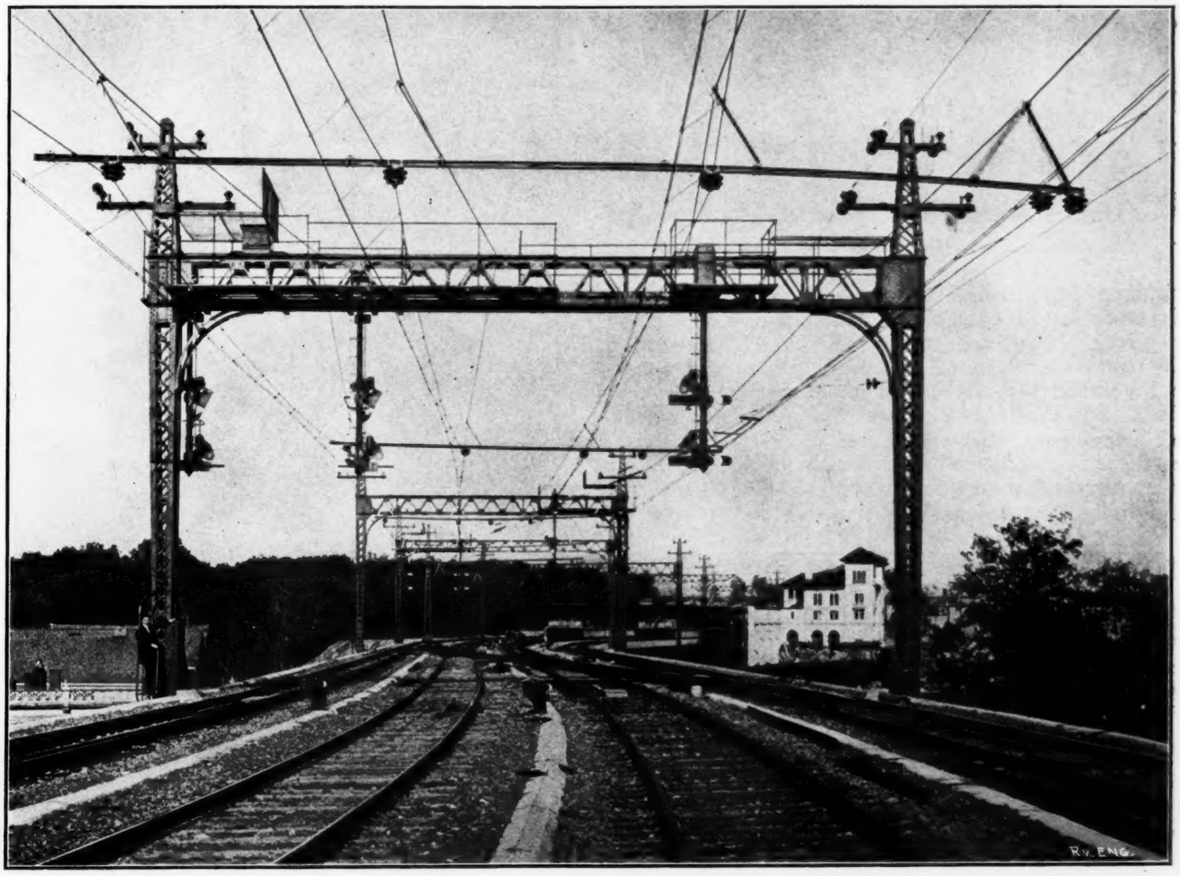
In order to successfully accomplish this the signal engineer, attracted by the simplicity of construction and operation of the A. C. system, and with a reduced maintenance charge beckoning him on, has nevertheless been confronted by a problem which looks paradoxical and might even humorously be stated as trying to "eat your cake and have it."

The practice on railways using a track circuit where one rail is employed for the return flow of the propulsion current and the other for the signal current, was comparatively simple. On the New York, Westchester & Boston Railway, which affords an excellent example of the double rail track circuit with A. C. equipment, both rails carry return current back to the power house, and at the same time retain signal current in both rails. The problem becomes simpler and its components assume definite values when intelligently attacked by the engineer; as a cloudy solution becomes clear when a precipitate has been thrown down.

The propulsion current delivered at 11,000 volts is stepped down to 325 volts by an auto-transformer carried on the car. It has a frequency of 25 cycles. The speed attained and power used is due to the system of voltage control by which alternating current is governed. The signal current is fed into the rails, about the centre of each block and is reduced or stepped down from 2,200 volts to about 18, and 60 cycles is the frequency.

It is providing this difference of the cycles in the propulsion (25), and the signal (60); currents which is the first step in the solution of the problem of passing one current along and isolating the other in each separate block. The rails are bonded together at each joint so as to produce what amounts to a continuous rail for the flow of both currents. This is carried out until the end of the block, and here both currents meet with an obstacle in the shape of an insulated joint. This joint separates the track as far as signaling is concerned, as if there was a gap of several feet, while the rails are as close together as they are anywhere else on the line. It is at this point that the 25-cycle return current must pass, on its way to the power house and the 60-cycle signal circuit must be held back.

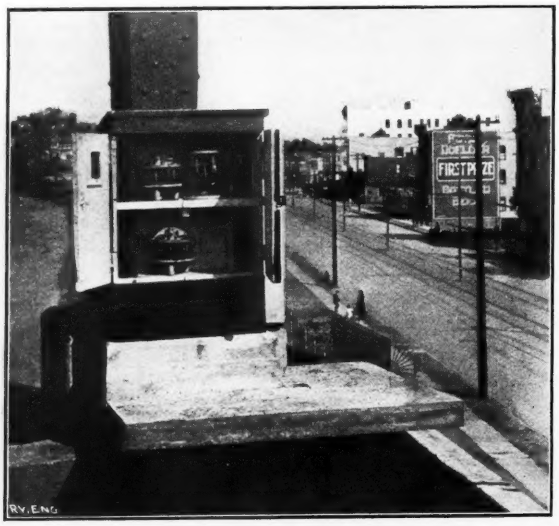
These effects are brought about by the use of what electricans call an impedence bond, and the design of this important piece of apparatus shows a rare degree of skill on the part of its originators. The impedence bonds may almost be called an electrical filter, as it permits the flow



View of New York, Westchester & Boston Railway looking south at 180th Street, New York.

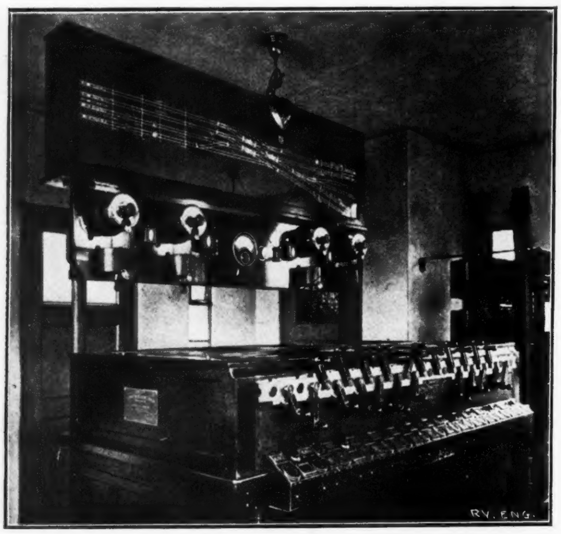
through it of the 25-cycle return current, but holds the 60-cycle signal current back.

The bond itself is composed of two soft iron cores wound round with bands of copper. One-half of it is perhaps more easily described than the two together. The half, on, say, the south-bound track, at the block end, is a soft iron core. From what would be the engineman's



Track Relay at Base of Signal Bridge at 180th Street, New York.

rail on a steam road, there comes a wire connection continued as band copper where it is wound round the soft iron core. Let us say, it is wound from left to right like the motion of the hands of a clock. From the fireman's rail a similar wire connection comes, but the band wire from it is wound from right to left, or in a counter-clockwise direction. The windings of the copper bands are arranged in exactly the proper number to obstruct the 60-cycle current, but they do not affect the 25-cycle current. This is because the number of turns closely correspond

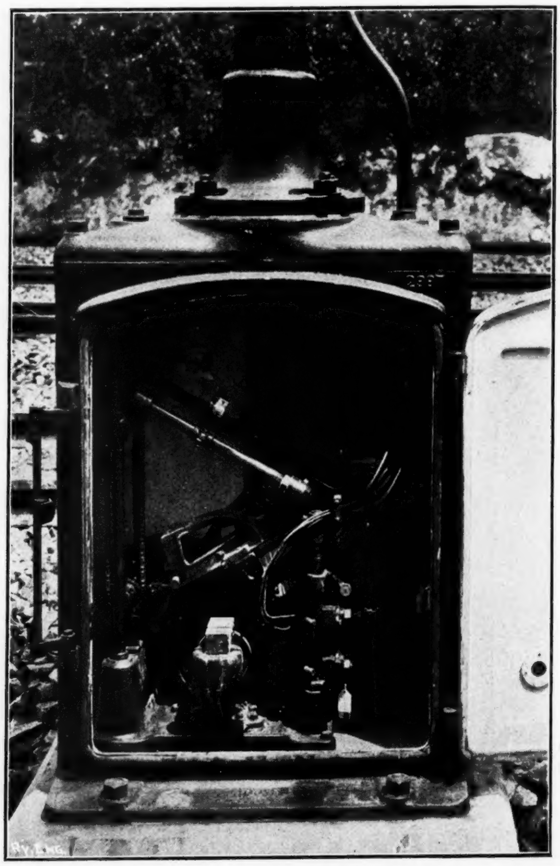


Signal Tower, N. Y. W. & B., at 180th Street, New York.

with the frequency of the propulsion return current and no inductive effect, sufficient to produce an obstruction, is encountered.

In the case of the 60-cycle signal current, the inductive effect produced in the oppositely wound coils of copper ribbon, is sufficient to neutralize each other and no signal current flows out of the block. The windings may be likened to two parallel shafts with a hand crank on the end of each, and men set to turn each shaft in the same direction. If these shafts carry each a gear wheel, which meshes one into the other, it would be impossible for the men to give either shaft any motion of rotation. Each man might exert a large amount of energy, but this would do no work, as the energy expended by one man would be completely neutralized by the exertion of the other, and both shafts would remain at rest.

One other illustration may help to make the neutralizing effect of the signal current in these two oppositely wound coils a little more clear to the mind. One must, however, make a mental picture of the current, and im-



Signal Mechanism at base of Semaphore.

agine it to be represented by a piece of wire, say twenty-five feet long, bent into exactly twenty-five zig-zags, each a foot long, with easy curves at the crest and hollow of the bends. If this wire be entered through a loosely fitting hole in a door panel, it can be pulled through with the greatest ease and smoothness if only the panel of the door is made to move, mechanically, up and down through one foot of distance, in a given time. The rise of the door-panel and the crest of the "wire-wave" then correspond. The hollow of the wire and the lowest position of the moving panel also coincide, and all intermediate positions of wire and panel are appropriate, each to each. The wire can therefore be drawn through with great facility.

If now, with panel moving up and down at the same rate as formerly, and twenty-five feet of wire bent into sixty zig-zags, be introduced into the loosely fitting hole, it is manifest that it will be impossible to get the 60-zig-zag wire through, because the motion of the panel does not correspond to the wave-like bends of the wire.

In some such way the opposite, or clockwise and the

counter-clockwise windings of coppr ribbon on the iron core permit the 25-cycle return propulsion current to pass through the impedence bond and at the same time to hold back the 60-cycle signal current in the rails. Cycles are measured, per second, and one current waxes and wanes, 25 times, and the other 60 times, in a second.

Now that the filtering action of the impedence bond has been accounted for, the use of the 60-cycle signal current, to operate mechanism to "clear" the signal, may be briefly considered. What is called a vane type relay is used on the N. Y. W. & B. It is enclosed in a glass case and is placed conveniently to each signal post. The track current normally flows through this relay, but the current is short-circuited if a train is in the block, and the relay is temporarily "cut out." When no train is in the block, the signal current enters the vane relay and energizes two small coils of wire, which stand on edge, and the magnetic force thus generated draws up a thin flat aluminum quadrant or vane, like the action of an ordinary solenoid. The vane, pivoted at one point, is lifted by the small, energized

Tandem Switch Mechanism, N. Y., W. & B.

coils and the edge of the lifted vane presses upon two springs and makes two contacts which close a separate, outside circuit. The flow of current through this outside circuit energizes a little magnet, and this magnet draws in a small latch on the stem or shaft of the signal, and the signal is thus held at "Clear." This is done when the rotation of the driving motor has ceased.

To operate the signal or let it go to the "Stop" position, a train in the block, short circuits the track relay, de-energizes the small coils, and the aluminum vane drops and breaks the contacts in the outside current; this de-energizes its little magnet and so releases the latch, and the signal goes to "Stop" by gravity. To pull the signal up to "Clear" again, the little magnet when energized starts a small motor put there to move the signal blade, and it draws in the latch to hold the signal, when at "Clear" again. This action is repeated as often as a train is anywhere in the block, as the presence of a car short circuits the current, and "cuts out" the track, or vane type relay. It thus prevents the relay from affecting the signal, by means of the outside circuit and its little magnet. A failure of the mechanism puts the signal to "Stop."

The New York, Westchester & Boston Railway Company have spent money freely to procure the best, and for them, the most suitable form of up-to-date signal equipment. In doing this, while the first cost is heavy, a comparatively low operating and maintenance charge has been secured, which in the long run will spell economy of a most substantial kind. In so doing the officials have, nevertheless, kept clearly in mind the convenience and the safety of their patrons. This conscientious feeling of responsibility in the performance of an implied duty, is evidenced in other ways by this corporation. It is not too much to say that the bright prospect for the future, as seen through the pages of the balance sheet, fades in the strong light that comes to the railway official with the full appreciation of the priceless value of a human life.

Men and women who love life as you do, and who have the right to life, trust themselves unhesitatingly on the road, officered by men who know its dangers and who have intelligently sought and found the best way to safety as they know it. No higher duty is thrust upon those who operate our steel highways to-day, and though its faithful performance brings no personal reward, the rendering of the words "Safety First," not a mere catch-phrase, but a working reality, raises the operation of any transportation property above the level of simply a "money getter," and places it high among the beneficent enterprises of our land. In Shakespeare's words it is, "When service sweat for duty, not for meed!"

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS

The Association of Railway Electrical Engineers held its eighth annual convention at Hotel La Salle, Chicago, October 19-22, and the first morning's programme included an address by the president, H. C. Meloy, of the New York Central Lines, and the report of the secretary-treasurer, J. A. Andreucetti, of the Chicago & Northwestern.

Edward Wray, Railway Electrical Engineer, Chicago, chairman, presented the report of the committee on data and information, including the association's usual statistics as to train lighting and shop equipment. The grand totals, qualified by some difficulty in securing information from all the railroads, showed 18,793 electrically lighted cars owned by the various railroads. There has been a great increase in the number of gas-filled Mazda lamps for yard and shop illumination, and also in the use of the larger sizes of vacuum type Mazda. The number of Cooper-Hewitt lamps reported this year is also greater than last year.

The committee on specifications for wire crossings for potentials above 100 volts, J. R. Sloan, Pennsylvania Railroad, chairman, reported that their endeavor to obtain representation on the national joint committee on overhead and underground line construction had been refused on the ground that the railroad interests are now sufficiently represented on that committee. The committee recommended that it be continued in order to keep in touch with the specifications and report to the association from time to time the determinations of the national joint committee.

The committee of standards for train-lighting equipment, D. J. Cartwright, Lehigh Valley R. R., chairman, re-

ported on Wednesday, limiting its report to details of minor parts of equipment. Reports were also read by the committee on electric headlights, J. L. Minick, Penn. R. R., chairman, and the committee on wireless telephone and telegraph as applied to moving trains, Dr. T. H. Millener, Union Pacific, chairman.

The committee on industrial tracks, T. V. Buckwalter, Pennsylvania Railroad, chairman, recommended standards, adopted by the association, in regard to capacity rating, speed rating and standard industrial truck voltage and standards for tire sizes. These standards follow very closely quite general present practice. An outline was given of the future work planned by the committee.

The committee on wire specifications, William A. Del Mar, Interborough Rapid Transit Company, chairman, presented an extended report including complete specifications on various kinds of conductors intended to supersede the 1914 specifications.

The committee on standard rules for car wiring, George B. Colgrove, Illinois Central, chairman, reported Thursday morning, introducing specifications to cover the complete wiring for lighting passenger cars, with a view of meeting the requirements of the Board of Fire Underwriters.

The committee on illumination, L. S. Billau, Baltimore & Ohio, chairman, reported that the committee had been investigating the lighting of classification yards. Owing to the rapid changes in the developments of lighting units, and therefore to the lack of data, the committee refrained from presenting any recommendations. Plans have been made to carry out tests during the next year. In yard lighting, the increase in the past few years of the use of Mazda lamps has now arrived at the stage where the chief development work has been toward increasing the number of sizes of gas-filled mazda lamp bulbs. This development work has progressed to the point where these lamps will also be available soon for train lighting service, and attempts are being made to reduce the number of different sizes of lamps that will be required.

The committee on standardization of crane turn-table and transfer table motors, H. C. Maloy, New York Central Lines, West, chairman, presented tabulated data of various kinds, but did not recommend standards at this time.

AVERAGE COST: CAUSES AND REMEDIES FOR SURFACING HIGH-SPEED TRACK

By "Experienced Foreman."

The cost of resurfacing high speed tracks averages about 38 per cent. of the money spent for maintenance. This figure varies according to local conditions. This may seem to many maintenance-of-way men a rather high figure, but it is not high when you stop to consider the time that is consumed on this item of maintenance. The tools for this kind of work, the tamping pick, and the raising bar have championed the cause for which they were invented, and from present indications they are here to stay. These track tools seem simple to many, but the work they do, under proper and experienced supervision, has much to do with the comfort of the traveling public, while on high speed railroads, there is no other tool in sight that will displace them. We have the pneumatic tamping machine, it however, is efficient on heavy work but not as yet on surfacing "Gilt Edged Track." There are many causes for continual surfacing, especially on high speed tracks. First: Consider the make-up of rolling stock, the speed, wheel pressure. Second: Sub-grade under tracks may be of such poor material as to be a cause for continual surfacing, especially at rail joints. Third: Rail splices which bend easily under wheel pressure cause the rail joints to dip in surface. Fourth: Cross-tie decay causes continual surfacing and also causes surface kinks in rails, which in many cases require rail renewal. Fifth: Center bound or dead track, as it is called, is a condition that should not be allowed to exist. Such track should be raised or pinched. Sixth: Poor drainage is the cause of more money being spent on surfacing high speed tracks, especially at rail points, than all other defects combined. Seventh: Carelessness on part of trackmen in not taking enough interest in this item of work. This means a waste of time and money.

It is our experience, that the resurfacing at rail joints on high speed tracks, costs on an average of 28 per cent. of the figure mentioned, which leaves only 10 per cent. for the surfacing of other portions of the track after a true grade has been established. The way to get the best results for the least money, is to use the man with long experience on this kind of work, it requires a thorough knowledge of track work, such a man must have a trained eye for small "kinks." It is to the well trained eye and practical experience of this man on surfacing high speed tracks, that much depends for the comfort of travelers.

A true line cannot be maintained unless a true surface grade is maintained, this same applies to either tangent or curve. The amount of time and money spent on surfacing either tangent or curve is approximately the same, it matters not whether it is one inch or 6 ins. elevation, that is necessary.

I am of the opinion that the amount of money now being spent to maintain a standard high speed track as far as surfacing is concerned, will in the future be minimized, by improving and water-proofing the sub-grade, to insure as near perfect sub-surface drainage as possible. Money spent on sub-drainage is money well spent. Clean ballast is an essential factor in maintaining good drainage. There are stretches of high speed tracks that are constructed on artificial sub-grade, such as bridges, etc. The surfacing of track on such structures costs approximately 25 per cent. as much as the same amount of track on earth sub-grade. About 18 per cent of this amount is spent on surfacing rail joints, the remainder on centers, etc. You can see that by water-proofing the sub-grade under high speed tracks, you will reduce roadway maintenance, also by the use of improved rail fastenings, you will decrease the existing figures on this item of maintenance. This might seem a rather expensive thing to do on account of the necessary change of rail appliances, but it will pay in more ways than simply decreasing the cost of maintenance. We understand that Maintenance-of-Way departments are non-revenue in the sense of money getting. However, any improvement made along the lines of maintenance betterment will save money, and money not spent is that much money earned.

The figures quoted are for money spent on the item of work known as surfacing only. Lining and gauging track, as a matter of fact, is very closely related to the item of surfacing. As far as maintenance is concerned, these are separate items and should be considered as such.

OUT-OF-FACE TIE RENEWALS

Editor, RAILWAY ENGINEERING:

Referring to your editorial in the September issue in regard to the "out-of-face" method of tie renewals. From experience I have found this method preferable to the single tie renewal method for the following reasons:

Under ordinary conditions where track is put up properly in continuous stretches, on untreated ties, it is seldom necessary to disturb the ties until they are renewed, there-

by minimizing the mechanical wear on the tie, eliminating the powdering of ballast caused by tamping and greatly reducing the labor costs.

Another important element in favor of the "out-of-face" method is the even bearing of the ties which in the single tie renewal method is impossible to obtain.

In intermixing sound ties with ties that have begun to decay the life of the tie is lessened by the spread of fungi from the decaying ties. In placing sound ties in continuous stretches the spread of fungi is considerably lessened thereby prolonging the life of the ties.

In "out-of-face" renewals, only carefully selected ties should be used, ballast should be clean and track well surfaced so that during the life of the ties they will be disturbed as little as possible in order to get the maximum life of the ties.

It has been demonstrated by actual experiments that where ties have been renewed "out-of-face" the life of the ties has been six and in some cases seven years with the yearly maintenance reduced to a minimum. In these experiments the track was perfectly safe for heavy traffic when the ties were taken out for the second "out-of-face" renewal.

Generally articles bearing on the subject of tie renewals "out-of-face," erroneously state that "the renewal is made when the ties are in poor condition to sustain traffic" or "when the track becomes unsafe for traffic." Track should never be allowed to become unsafe under any conditions or method of tie renewals, but should be at all times maintained in a safe condition and ties renewed before they reach an unsafe condition.

When creosoted ties are used to replace untreated ties by the single tie renewal method, it is very doubtful if any economy is effected by their use as the ties are subjected to frequent disturbances caused by replacing ties that have served their life. The mechanical wear caused by the frequent disturbance to the ties shortens the life considerably, the ballast becomes foul, thereby necessitating forking or replenishing at considerably shorter intervals than is the case when disturbances to the track are less frequent, the spikes are loosened and the ties are rendered unfit for service by mechanical wear before they should have developed any sign of decay had there been less disturbance to the track.

From actual cost data, one mile of track renewed in a continuous stretch is as follows:

2,880 ties at 52c	$1,497.60
Labor (placing and surfacing)	1,130.00
1,000 yards ballast at 60c	600.00
	$3,227.60

The minimum life of this stretch of track is 6 years and on this basis the cost per mile per year is $537.93.

For creosoted ties the following estimate has been made:

2,880 ties (full plated) at $1.075	$3,096.00
Labor (placing and surfacing)	1,130.00
2,000 yards ballast at 60c	1,200.00
One intermediate surface	585.50
	$6,011.50

A comparison from the above figures, show that the use of creosoted ties results in economy when the life is twelve years or more.

If creosoted ties are placed in continuous stretches it is necessary to make only one intermediate ballast renewal and surface during the life of the ties, the balance of the time the ballast and ties are practically undisturbed and, in all probability, the ties will be servicable for at least fifteen years and a considerable economy is effected by their use, but if creosoted ties are used in single tie renewals it is doubtful if the life is more than ten or eleven years, in which case there is no economy in their use.

Yours truly,
R. P. TRABUE,
General Roadmaster,
Nashville, Chattanooga & St. Louis Ry., Nashville, Tenn.

ANXIOUS TO DO GOOD WORK

Editor, RAILWAY ENGINEERING:

I have often wondered, and no doubt many another railroad man has wondered how in the world it was possible for trains to operate over some sections of track they have seen and how with the poor equipment and signal service more damage was avoided. Of course, such conditions are deplorable and especially so to those having the care of track and the safe passage of trains in their hands. Strange as it may seem, when earnings fall off and retrenchment follows, the section staff are the first and hardest hit. This policy inclines the railroad man to take chances on material and roadbed, holding up just a little longer than his experience and judgment dictates that it should. He knows that he is gambling with human lives at stake as well as property but he cannot help himself. It takes money he cannot get, and he plays the margin of safety to the smallest limit.

Government and legislative officials do not seem to realize that these conditions exist when they propose to take steps which hit at railroad revenue. It is their beast of burden to underfeed and maltreat as they choose. In the event of a wreck they are the first to blame the management, to the delight of the voter who wants to see the big rich company catch it. While I am of course in favor of the campaign for more care in the selection of these officials, I wish to suggest a campaign for more careful analysis of the acts of these officials. A great many capable and broad-minded men would no doubt be attracted by these positions were it not for the fact that they would be subjected to so much careless judgment and personal vituperation.

The American Telegraph & Telephone Co., which has not been so much the victim of malicious persecution, spend over a million dollars a year on scientific research for better material and equipment. Yet railroads are not allowed a decent operating income, much less money for a purpose of this kind. The result of the telephone company's efforts has been better service and lower rates. The time is here when railroads should be in a position to dictate to manufacturers their specific requirements in material and methods of manufacture and equipment, and not be forced to depend so much upon what the manufacturer thinks he can sell, the quality of his production being determined at the expense of the railroad. The telephone company is allowed to cheapen talk, but the safe-guarding of human lives is not held so dear.

The various societies do their part and individual scientists contribute, but the result of their efforts cannot always be applied to fit the peculiar conditions on various parts of a large railway system. In many instances these conditions demand the concentrated study of a specialist with a well-equipped laboratory and the ability to easily secure data. Well planned and executed publicity campaigns have worked wonders for other public service corporations, why would not a concentrated co-operative campaign, national in scope, pointing out the truth and showing the connection between cause and effect, secure the necessary result for railroads?

C. E. N.

Leesburg, Fla.

McCOMB, MISSISSIPPI, APPRENTICE PLAN

By N. N. Seney, Director of Co-operation.

Many efforts have been made in the past few years to solve the problem which the apprentice of to-day presents. Not over half of our apprentices have a grammar school education and very few indeed have a high school diploma. We have reached the time where the success of the mechanic depends not only on his ability as an artisan but on his education as well. Experience shows that the amount of promotion a man receives is directly proportional to his education. The problem, then, is not merely to teach our boys a trade, but to educate them. On the training we give these boys depends the efficiency of tomorrow's progress.

The problem has received much attention, not only from employers, but in educational circles as well. Many solutions have been suggested and a few are in operation. Some of our large railroad systems and manufacturing concerns have installed elaborate apprentice school systems. They have employed skilled technical instructors and shop demonstrators in the effort to produce the desired kind of mechanics. They have met only a measure of success. This is due to two reasons. First: that not enough time can be devoted in the shop to give the liberal education desired. Second: that the average apprentice has such a limited education to start with so that but little of practical or technical value to his employer can be accomplished. In the minds of many people there is a serious doubt, if not a conviction, that the results obtained are out of proportion to the expenditure required.

Our public schools have taken up the problem under the name of "Vocational Instruction." Wood working shops, forge shops, and even machine shops have been installed in many high schools, and in them skilled instruction is given to the school boy. This effort is in the right direction and is commendable. However, it is only feasible in the large cities on account of the outlay required to install a complete system. It is not the object of this department of public education to turn out finished, practical mechanics and so this effort falls short of solving the apprentice problem.

To meet the serious objections and shortcomings of the above mentioned plans we have evolved a system of handling apprentices in the city of McComb which is worthy of careful consideration. The system is not the result of a day's scheming, but constant study and three years of steady effort have been necessary to bring the plan to its present development. The solution we have is the "co-operative apprentice." The plan is this: Worthy high school boys over 16 years of age will, as vacancies occur, be given employment at the local shops of the Illinois Central Railroad Company as co-operative apprentices. Co-operation, with us, means the working together of our industrial institutions and the public schools, in an effort to teach boys a trade and, at the same time, educate them.

We now have twenty-eight co-operative apprentices, working for the Illinois Central. These boys spend their vacation in the shops and during the school year they spend half their time in the shops and the remainder in the high school. Ninth and tenth grade boys are in school while eleventh and twelfth are in the shops. They alternate each week and the number in each weekly group is kept as nearly balanced as possible, thus assuring a constant force in the shops. While in the shops, these boys are given practical instruction by the foreman and fellow workmen. A fixed schedule is used which governs the boy's transfer through the shops. This schedule sets the maximum time which a boy is allowed to remain on any one branch of work in his trade. This assures an all round experience.

In the shops, these boys are required to attend our shop apprentice school for a period of one hour every other day. They are here given instruction in reading working drawings, shop sketching, and mechanical drawing. We are also able to devote some time to the consideration of the properties of steam, combustion of coal, and kindred subjects. Every possible effort is made to correlate our technical instruction with actual shop practice. Co-operative apprentices are required to serve a five year term. Four years in school and one full year after graduating.

Special arrangements have been made by our public school officials which enable our apprentice school boys to graduate with the rest of their class. Eighteen units are the normal requirement for graduation. Four units are allowed for the work in the shops and two units for apprentice school work. The remaining twelve units are earned in high school by taking three subjects each year, consisting of English, mathematics and the sciences.

The system, as we now have it, meets the approval of all directly concerned. Shop foremen find that by weekly alternating plan, shop work is not interfered with, and that each period in the shop is long enough to enable a boy to keep up his efficiency to that of the regular apprentice. Our high school teachers are able to take care of the weekly alternation without confusion, and report that the grades made by the co-operative boys are equally as good as those of the regular school boy. I wish to call attention to the all round benefits of this plan. The superiority of these boys as apprentice material is beyond question. They have a good education, which is a solid foundation on which we can build our technical instruction. This class of boys has a better education at the beginning of their apprenticeship than the average shop school educated boy has at the end of his time.

A very wholesome effect is noticed in our high school classes. This plan keeps the boy in school. Where we used to have from one to five boys in the graduating class we now have double or even treble that number. This fact in itself is an accomplishment much to be desired. The plan gives energetic boys, even though they may be poor, a chance to learn a trade and at the same time secure an education. The efforts of these boys are the best indications of future worth. For such boys we can consistently put forth our noblest efforts in the class room as well as in the shops. Everyone we assist in this manner makes a better man, a better mechanic, and these in the aggregate a better community.

In conclusion we may say that the development of the plan has been made possible only through the hearty co-operation of the local Illinois Central management and our city school officials. In the city of McComb the system has passed the experimental stage and is already being extended in other directions. We have boys in our city electric light plant, some in planing mills and still others out on the I. C. R. demonstration farm. The success and practicability of our plan are already sufficient to warrant its general adoption. We are convinced that a fair trial will convince the most skeptical of its merits. The interest and support given by the people of the city amount to public approval of our plan, and we have hope to see, in the near future, its general adoption. Any special information desired will be gladly furnished, for we realize that in so doing we can stimulate interest in this plan, which we believe to be the logical solution to the apprentice problem.

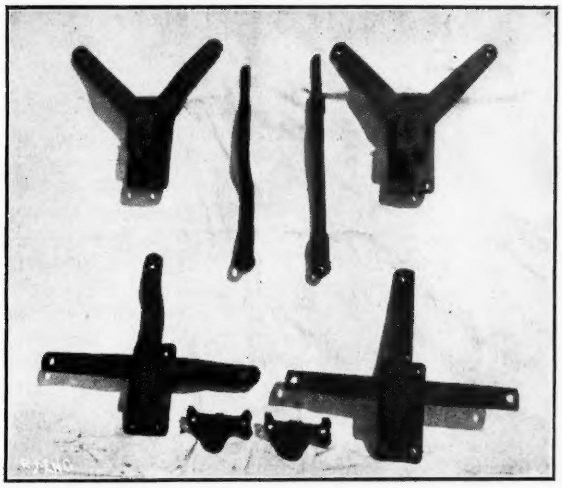
It is not the events of life, nor its emotions, nor this nor that experience, but life itself which is good.—*Phillips Books.*

It is doing things that count. One may have all the good intentions in the world, but if they are not made manifest in deeds, what do they amount to?—*Selected.*

RECLAIMING SIGNAL MATERIAL FROM SCRAP

By M. E. Caroll.

Until within recent years, material for repairs and upkeep of signals on railroads has been a comparatively unimportant item. The use of such material was confined to a few scattering interlocking plants and occasional short stretches of block signals on important main lines, ma-



Cranks, Jaws, and Rail Clip, Reclaimed.

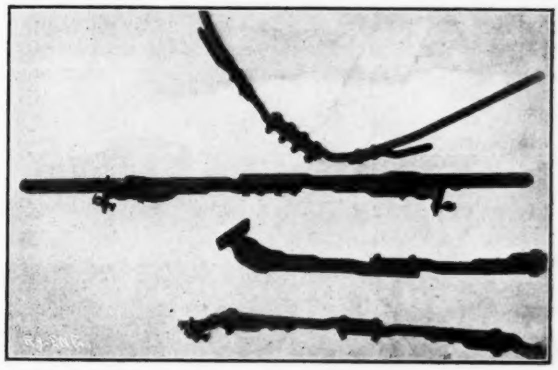
terial being purchased directly from manufacturers for each specific job of repairs. We have now reached the time, however, when almost every railroad crossing has its interlocking plant, and not only all main lines, but many of the more important branches, are protected for their entire length with automatic block signals, with added installation of highway crossing bells and signals, station annunciators and similar devices. These are more readily installed where track circuits are in operation. Under such conditions, the item of signal material becomes one of considerable importance, each railroad of 5,000 miles or more finding it necessary to carry anywhere from $50,000 to $100,000 worth of material on hand at all times for protection or prompt renewal at their signals and interlocking plants.

On some railroads it is the practice to maintain signals, and especially interlocking plants, with the smallest possible expenditure of labor or material, until the apparatus becomes so worn as to necessitate a general overhauling. It is then the practice to send a floating gang of considerable size to entirely rebuild the plant, or repair and renew the signals on an entire division. This practice results in considerable accumulation of scrap material, and while the floating gangs are usually equipped with forge, drill press and similar tools, in their natural desire to thoroughly rebuild, with new material, the plant to which they are assigned, they too often ship away in scrap cars a great amount of material which might possibly have been reworked and put to further use if more time or greater care had been employed.

On other roads where the maintenance of interlocking plants and block signals is given daily attention, the attempt is made to economize in the use of new material by keeping the old material in service as long as possible. Unfortunately, however, territories are often too large for the maintainer to properly attend to. The result is that he is pressed for time and finds it necessary to use new material when he should have reworked the old article and made it fit for further service. Under either of these plans, material often goes to the scrap cars, which under intelligent supervision and an efficient system of repairing could have been made the equivalent of new.

On one of the large railroad systems of the Central West, the man who handled the scrap material at the central scrap dock began to set aside certain items of signal material received in scrap cars. When authority was asked, for the supply of some small articles to use in repairing this material and putting it in shape for further use, the signal engineer thought anything which reached the scrap pile was scrap, and he therefore did not favor the idea of reworking the material referred to. Later, a conference of the heads of Signal and Maintenance of Way Departments was held at the aforesaid scrap dock, and the signal engineer was greatly surprised to find that the possibilities of repairing scrap signal material was easily proved. As a result, in addition to tightening up on supervision of signal repair work on each of the operating divisions, authority was given to instal a small forge, anvil, drill press, grinding wheel and vise at the general scrap dock. A regular system was then established for inspecting all inbound scrap, setting aside repairable materials and a small shop, made of two discarded car bodies, was built at the scrap yard.

Now when the scrap material is brought to this place, it is first dropped into a vat of hot lye water, which removes the grease. The material is then taken apart, holes in cranks, compensators, screw jaws and similar articles which have become worn out of round are either plugged and redrilled, or in case of L cranks and T cranks they are upset and reamed out to the original diameter. Where old pins and studs are too badly worn for use, they are replaced by new ones. All finished articles are given a coat of black paint and sent out from the shop as good as



Insulated Bridle Rods, Reclaimed.

new. A careful record is kept of the weight of scrap material delivered at this shop and of all expenditures for labor, fuel, power, new material, etc., and repaired material are credited to the plant at the value of new. On this basis the monthly saving ranges from $300 to $450 per month, which is a clear gain, as the material would otherwise be sold as scrap.

In one of our illustrations, there is shown two cranks, a solid jaw and a rail clip as taken from the scrap, and corresponding items after being repaired and painted. Such cranks are in general use, they are subjected to constant wear, and when they become faulty because of lost motion they are discarded by the division repairman. As scrap, they are worth only 11 cents each, yet they can be repaired for an average cost of 54 cents, labor and material, and are then worth from $1.40 to $2.15 each, according to size and type.

The item of solid jaws is one of constant expense, because of wear, failure through bending and damage by

derailments. It is a very simple matter, however, for a blacksmith to upset the eyes and ream them out to the original diameter and otherwise repair them so as to be equivalent to new. These scrap jaws are worth only 5 cents as scrap and average cost of labor repairing them is 11 cents each, while new ones cost from 44 to 52 cents each. The average rail clip is worth only 6 cents each as scrap, yet they can be reworked and new studs applied at a maximum expense of 30 cents each for badly damaged or worn clips, and they cost 46 cents each new.

In the other illustration is shown insulated bridle rods, as taken from the scrap pile, and similar rods fully repaired, ready for use. The head rod costs new $4.75 each and the intermediate rod $3.75 each, their scrap value being about 50 cents, while the average cost of repairing and reinsulating 200 of these rods amounted, for labor and material, to $1.17 each. In a recent case of derailment, at a home signal, a two-arm pipe connected signal was demolished and loaded up with other material as scrap. At the rate of ½ a cent a pound, this signal was worth only $7.40 as scrap, yet by an expenditure of $8.20 in labor, the application of new blades and spectacle castings, and a coat of paint, this signal was reissued in working order, equivalent to a new signal, at a net saving of $69.73.

It is found that compensators can be entirely rebuilt and issued as new, at saving of $4 each; pipe carriers at saving of 18 cents each; links at saving of 16 cents each, and so on down the list, there being almost no limit to what may be accomplished by a handy, intelligent blacksmith, having only the equipment above described.

While to most railroads, the figures quoted above will seem out of line, for they will say along with the signal engineer already quoted, "We are doing our work on the line and do not permit this stuff to get to the scrap pile," yet a close, intelligent supervision of the scrap pile on any railroad will show that there is a certain amount of scrap signal material going to the junk dealers which could be turned into real money if properly handled and repaired, and not prejudged as scrap when a little work on it would make it serviceable again.

THE CINCINNATI SOUTHERN RAILWAY

The only instance of a municipally owned railroad in the United States—save possibly the New York City Subway System—is the Cincinnati Southern, now under lease to and operated by the Cincinnati, New Orleans & Texas Pacific Railway Co.—a holding company—dubbed by those who are fond of brevity and delight in nicknames, as the "Queen and Crescent"—a euphonious pseudonym with an extremely apropos origin. This enterprise was conceived as long ago as 1836 when the locomotive was regarded as a demon which could do little else than throw out fire brands at every puff and leave destruction and desolation in its wake, from hamlet to city and beyond. The Cincinnati Southern was a true business scheme on the part of the city to aid the growth of Cincinnati by securing trade from the South and Southeast, which at that time had only found its way as far north, in that region, as Louisville, and Charleston, South Carolina, was the intended objective point. After more than 40 years from its original conception it was eventually completed to Chattanooga, which was its final terminus, and it then became one of the important Southern lines. To-day it still carries that reputation.

A constitutional provision forbade a city to loan money to any private corporation to build a railroad, and while the desire for a southern connection was running high and the plan seemed to be going astray, it dawned upon a then rising young lawyer of Cincinnati that if the city could not loan to such a corporation there was nothing in the law to prevent the city from building a railroad on its own account and for itself. A bill with this in view was thereupon introduced at Columbus; was passed by both Houses of the Legislature, and later became a law, under certain requirements and regulations. Five commissioners or trustees were then selected to carry out the terms of the bill.

The City Council were authorized to issue $10,000,000 bonds and did so. More were issued later as money was needed. The measure was promptly attacked in the courts by the economists of those times; but like all efforts devoted to the public good the railroad scheme outlived its opponents and became, eventually, an assured fact in the Cincinnati Southern Railway. Kentucky and Tennessee fell into line and passed necessary legislation in keeping with what the State of Ohio had already done in order that the road might be extended to Chattanooga. All this, however, not without strenuous opposition, which was referred to by the projectors as "a small but persistent residuum of local hostility." The Cincinnati Southern when completed was 336 miles in length and was of five feet gauge, corresponding with the other roads in the South at that time; but later was changed to the standard of all lines in the United States, four feet eight and one-half inches. The specifications governing its construction were exacting in the extreme and to the end that when it should be opened for business it would be a first class railroad in every detail. It cost in round figures about $24,000,000. On February 21st, 1880, the first through service from Cincinnati to Chattanooga was put in vogue. Having accomplished its object of securing good railroad connections with the South the city was then in position to part with its property and be relieved of further care. The General Assembly of Ohio therefore, on March 18th, 1881, passed an act directing the trustees of the property to either lease or sell the railroad on certain terms and conditions. It was deemed best to lease, and on October 11th, 1881, the lease was made for a term of twenty-five years to Frederick Wofe and associates, and immediately thereafter it was assigned to the Cincinnati, New Orleans & Texas Pacific Railway Co., a holding organization devised for this special purpose.

Under the terms of this contract the lessee was required to pay $800,000 per annum in cash for the first five years, $900,000 for the second five years, $1,000,000 for the third five years and $1,250,000 for the fourth five years. The lessee, too, had to assume all assessments and taxes, make all repairs and maintain the property in first class condition. The principal office must be located in Cincinnati, and the lessee was further called upon to pay $12,000 a year for the expenses of the trust. As a means of adding to a determined growth of the city of Cincinnati and putting that municipality in the rank of first class cities the Cincinnati Southern accomplished the purpose most successfully. The original lease which expired in 1906 was extended for a further period of sixty years under provisions which called for $1,050,000 for each of the first twenty years; 1,100,000 the second twenty, and 1,200,000 the third twenty. Under the direct management, to-day, of the Southern Railway Co., which controls the Cincinnati, New Orleans & Texas Pacific, the Cincinnati Southern has developed into a railroad of the first class. From an original few hundred thousand dollars of earnings per annum it is now earning nearly one million dollars gross per month. It is maintained in excellent condition and is an important link in the Queen and Crescent route to New Orleans. The entire country through which it runs is building up rapidly, and industries of all sorts are keeping the line busy from one end to the other. It was a wise move on the part of those enterprising citizens of Cincinnati when they planned and built the Cincinnati Southern.

Annual Meeting of the Railway Signal Association

The 20th annual convention of the Railway Signal Association was held in the Hotel Utah, Salt Lake City, September 14th, 15th and 16th, and brought together a good representation of the members and particularly the western signal men. Following the invocation and an address by Mayor C. E. Park of Salt Lake City, the annual address was read by President Stephens, in which he pointed out the responsibility to the Association of the individual members.

The report of the committee on signal practice dealt with switch indicators, economics of signal maintenance, the capacity of single track and to the use of the A. R. A. clearance diagram. It was recommended that fire statements of practice, with respect to the installation of switch indicators be referred by letter ballot to the membership. It was recommended that no combination be made of signal and track forces on account of the difference in training required of the men for the different departments. Specific cases might make exceptions to this rule advantageously, but these are left to the individuals in charge of such work.

F. L. Dodgson, consulting engineer of the Railway Signal Co., presented a paper dealing with the capacity of single track, in which he analyzed the effect of the location of passing sidings and pointed out by means of formulae the methods of determining the most advantageous locations. It was recommended that the standard for limiting clearance lines over third-rail and permanent way structures and rolling equipment, as adopted by the American Railway Association, be not reproduced by the Railway Signal Association, but be used as it is corrected from time to time in the proceedings of the American Railway Association. In the discussion several suggestions on proposed additional requisites for switch indicators were referred back to the committee.

The committee on mechanical interlocking presented specifications for electro-mechanical interlocking, and the discussion brought out so many points where the proposed specifications differed from present practice that this subject was referred back to the committee.

The committe on power locking presented specifications for fibre conduits, incandescent lamps and electro-pneumatic interlocking. Specifications for fibre conduits were referred back to the committee, the other two, with minor changes, will be referred to the Association by letter ballot.

The committee on automatic blocks presented revised specifications for crystallized copper sulphate which were accepted practically without change.

The committee on manual blocks presented for consideration codes of instruction covering testing and maintaining dry cells, maintaining gravity cells and maintaining caustic soda cells and the reports will be submitted by letter ballot.

The committee on standard designs submitted twenty-one revised drawings and six new drawings shown in the March and May issues of the Journal of the Association, and these will be submitted with the other committee reports. There was some favorable discussion also of a proposed new switch and lock movement and various subcommittees presented incomplete reports.

The committee on relays made no recommendations for immediate changes, but have been working along the line of standardization of parts and securing to this end the co-operation of the representatives of the manufacturers of signal equipment. Tests were reported and the committee has made some tentative recommendations for a more perfect relay and to that end has requested several items of information from the various members. In the discussion the committee was complimented on its method of attacking the problem by research rather than by discussion, and reports will be made as the work progresses.

The committee on electric railways and A. C. signaling submitted information regarding the use of the alternating current signals on a number of steam and electric roads and recommended that it continue its work along the lines of preparing existing and new literature on this subject for the use of the members of the Association.

The committee on storage battery and charging equipment presented information in regard to lead stationary storage batteries of types other than pure lead and also data in regard to the average cost of current for charging storage batteries. Specifications were presented for the new iron-nickel-alkaline storage battery and work on the development of a combined hydrometer and thermometer for stationary storage batteries was described.

The special committee on electrical testing presented a report showing progress and requested discussion tending to indicate the Associations desires in the way of future work.

The special committee on lightning protection submitted recommendations covering lightning arresters, A. C. signaling choke coils, and specifications for vacuum-gap arresters. This report was accepted with a brief discussion.

The following officers were elected for the coming year: President, W. J. Eck, signal and electrical engineer, Southern Ry., Washington, D. C.; first vice-president, Charles A. Dunham, signal engineer, Great Northern, St. Paul, Minn.; second vice-president, W. H. Elliott, signal engineer, New York Central Lines East, Albany N. Y.; secretary-treasurer, C. C. Rosenberg, Bethlehem, Pa.; directors, C. J. Kelloway, signal engineer, Atlantic Coast Line, Wilmington, N. C.; A. H. Yocum, signal engineer, Philadelphia & Reading, Philadelphia, Pa.; J. C. Mill, signal engineer, Chicago, Milwaukee and St. Paul, Milwaukee, Wis.; and W. M. Vandersluis, signal engineer, Illinois Central, Chicago; nominating committee, F. C. Stuart, signal engineer, Elgin, Joliet & Eastern, Joliet, Ill.; Oswald Frantzen, supervisor of signals, New York, New Haven & Hartford, Boston, Mass.; P. F. Bikle, assistant foreman of signals, Pennsylvania Railroad, Johnstown, Pa.; and J. P. Spoerl, signal foreman, Chicago and Northwestern, West Chicago, Ill. The Grand Hotel, Mackinac Island, Mich., was chosen as the place for the 1916 meeting.

The Cincinnati Screw Company at Twightwee, Ohio, have recently purchased the plant and equipment of the Cincinnati Screw and Tap Company, consisting of over 100 automatic screw machines from 3/4 in. to 2 ins. Capacity of the plant is by this time in full operation.

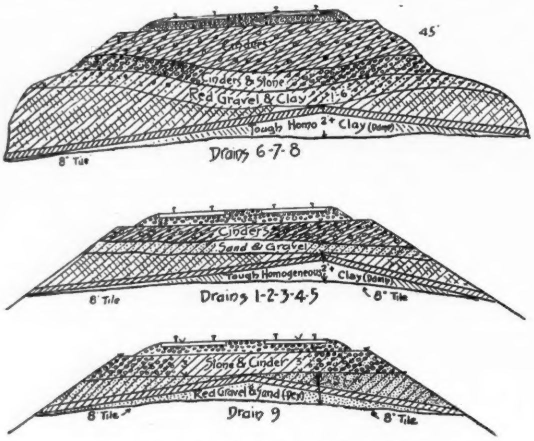
RAILWAY TIES, SHINGLES, ETC., No. 17930.—The Department of Commerce is in receipt of a letter from a business man in Canada stating that he desired to communicate with American exporters of railway ties, shingles, doors, window sashes, etc. The ties should be of hard and soft wood and have the following dimensions: Four inches by 8 inches by 8 feet, 10 inches by 10 inches by 9 feet, and 5 inches by 5 inches by 9 feet.

DRAINAGE OF COWENTON FILL, 0.5 MILE EAST OF COWENTON, MD., PHILADELPHIA DIVISION

By the Engineer Maintenance of Way, B. & O.

The total length of the fill is 1,000 ft., being entirely on a tangent, grade being 0.8 per cent. descending west. At a point 200 ft. westward from the east end of the fill it is crossed by a stone box culvert 3 x 4 ft. The portion of the fill west of the culvert is substantial, and gives no trouble in maintenance of track. The portion of the fill east of the box culvert has always been a source of trouble, however, due to the continuous though uneven settlement of the track, caused primarily by movement of the material in the roadbed.

The underlying strata in the fill was found to be a tough, homogeneous clay, yellow in color, and, though plastic, appeared to be quite impervious to water. Overlying this was a layer of sand and gravel of varying thickness. The sand, which formed the greater bulk of this layer, was of the quicksand variety, being rather flaky and crystalline and red in color. Throughout the fill it was noted that this layer was saturated with water, though the excavations incident to the work were made during a period of exceptionally dry weather in August and September.



Drainage Methods on the B. & O.

A further characteristic of the location is the original ground surface. This appears to be a swamp on both sides of the embankment extending from a point 100 ft. east of the culvert to a point about 200 ft. eastward. The contour of the ground is, however, descending towards the culvert.

As shown in the illustrations, the fill was considerably widened and slope distorted by the outward movement of material, evidently caused by the imposed load and shocks of moving trains. A pronounced tremor was noticeable as trains passed. The constant settlement required an excessive amount of line and surface work to keep tracks in shape. It was estimated that the section gang spent one-fourth of their working time on tracks at this point, and that the average yearly maintenance cost was approximately $1,000.

The opinion prevailed that the presence of water in the embankment as well as poor drainage of adjacent ground was responsible for the movement of the roadbed. It was therefore decided to construct a toe-of-slope ditch on each side of the embankment running parallel to the track carrying drainage to the stream at the box culvert. Lateral drains in sufficient number to drain any pockets encountered or to prevent saturation of material were proposed as a remedy to the internal condition of the fill. The toe-of-slope ditches were constructed as planned, and provided water courses permitting rapid run-off of water drained to them.

Nine cross-drains through the fill were constructed. No. 1, which was located at east end of fill, was but 3 ft. below base of rail at the bottom of trough. Water, from a spring or from drainage of tracks from adjacent cut, was encountered and deflected. This stream in small quantity has been running continuously since.

Drains No. 2, 3, 4 and 5, constructed in subsequent rotation, were dug through portions of the fill, which gave no evidence of excessive movement of embankment, though at No. 3 it had been widened to some extent from that cause, being particularly noticeable near toe of slope. As noted in the sections there was approximately 3 ft. of cinders above the sand and gravel strata in this portion of the fill. This latter strata, however, was saturated and appeared to be the cause of settlement. The fact that a greater thickness of this sand and gravel layer existed near the slopes indicated that the pressure tended to force this material outward, sliding it upon the underlying strata of clay.

Drains 6, 7 and 8 were constructed through the portion of the fill where the greater amount of settlement was apparent. Here was found more evidence of pockets than elsewhere, as the underlying clay had been forced upward near the slopes in such manner as to retain the moisture.

The method of constructing drains was as follows: Two stringers, 20 ft. switch timbers, were placed beneath ties under each rail spanning the drain location. Ties were temporarily supported by blocks whilst excavations for these stringers proceeded. Wedges were inserted between the stringers and ties in order to maintain track in surface. Tamping beneath the stringers was also required. Excavations for the drains, 4 ft. in width, began at top of roadbed, and were carried downward until the clay strata was reached. Sheathing using 3 x 6 in. timber of average length of 14 ft., placed horizontally along each side of drain and properly braced by pieces of 3 x 6 ins. extending across drain, followed closely upon the excavations to prevent caving of embankment. The character of material required that care be exercised in conducting the work, to avoid collapse and to see that the sand did not flow beneath sheathing into the excavation and develop a soft spot resulting in bad track surface.

As soon as excavation was completed the 3 in. terra cotta pipe was laid and the trench filled to sub-grade with rubble stone. The drains were built consecutively, no more than two being open beneath tracks at the same time. There was an average of twenty men employed on the work for a period of six months.

The cost was as follows:

Labor:	
Excavating, placing stone	$653.31
Installing stringers, sheathing and bracing	738.17
Material:	
1,410 tons marble stone	654.50
Lumber	342.46
Terra Cotta pipe, 600 feet	90.00
	$2,456.44

Upon completion the fill was leveled to sub grade and stone ballast supplied to tracks. Fork on drains was completed September 30, and the track ballasted and surfaced early in October.

To date the results of the work have been satisfactory and material benefit under severe weather conditions is anticipated.

A Great Freight Terminal

Not many years ago the water front of South Brooklyn, above and below Thirty-ninth Street, was backed by 200 acres of waste land with no apparent likelihood of its ever becoming productive. Under the generalship of a great master of industry this extensive tract has been developed, within a few years, into one of the greatest freight terminals in the world, a scene of life and activity, with its docks, slips, tracks, great warehouses and massive loft buildings, creating one of the busiest sections in all Greater New York. This tremendous enterprise did not require so much engineering skill in its conception and construction as it did faith on the part of its projector in the ultimate success of a scheme which involved the outlay of millions. It was something decidedly novel in the way of freight terminals. To-day practically all the space in the 200 acres is occupied by buildings and other necessary structures, and 99 per cent. of the warehouses and loft buildings are under rental for business purposes. Within the boundaries of this immense terminal are established industries, initialled by every letter of the alphabet, engaged in the manufacture of most every known commodity in the markets, from shredded cocoanut to the most stable articles of commerce. Here is a great centre where the raw materials are shipped in and the manufactured products are shipped out, to all parts of the globe, by land or sea. It was economy in the first place and facility next which were the inducements offered these various industries to locate here, and their proprietors have found every expectation realized.

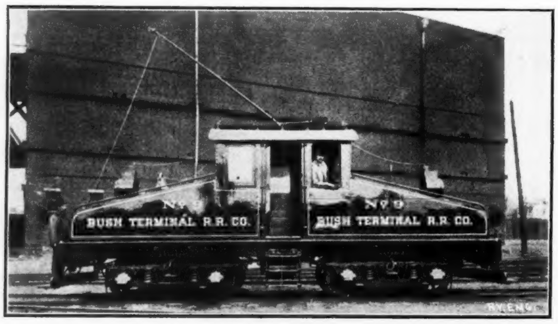
Side and End View of a Section of Eight-story Loft Building.

Some of the Terminal Piers. Loft Building and Warehouses Seen in the Distance.

The general arrangement of this terminal, which quite properly bears the name of its enterprising promoter, Bush, consists of piers, constructed of steel and concrete, for steamship dockage and the necessary float bridges for handling the car floats which ply to and from the various railroads terminating in New York and vicinity. Back of these is a general freight yard laid out in a system of ladder tracks for storing and switching purposes, and convenient to the warehouses beyond. This freight yard connects with a main line, so to speak, having spurs running to and into the neighboring warehouses as well as all the loft buildings which occupy the blocks on the north end of the terminal property—a little railroad system by itself of 25 miles. This plan is shown by the accompanying drawing. The warehouses which were originally erected are low buildings, and to-day fall short of their requirements. They will be replaced by something more suited to the present demands. In them are stored vast quantities of raw materials which, as needed by the manufacturers occupying spaces in the loft buildings, are hauled by electric engines over the main line from which the cars are conveniently placed at the proper platforms. Engaged in the receipt and output of the enormous quantities of freight which are daily handled are ten car floats of sixteen cars capacity each; 3 steam tugs; 7 switching engines; and 3 electric locomotives. As more than 350 loaded cars are handled every day, it can readily be understood how busy the motive power is and how much engaged the car floats and other facilities are. In addition are barges and lighters, tractors and trailers, motor delivery trucks and wagons for heavy teaming. The immense loft buildings, seven of which now occupy the blocks running north from Thirty-seventh Street, are substantially constructed of steel and concrete, 600 to 700 ft. long, 75 ft. wide, and 6 stories high, with more than suitable elevator service. In the blocks adjoining the system of warehouses are other loft buildings of similar construction 8 stories high, and more are already planned for construction. All these buildings are open 24 hours a day including Sundays and holidays, while mail service is

especially convenient, since one of the buildings supports a United States post office with all its facilities.

One example of the efficiency of this mighty terminal will suffice to explain the operation of the entire plant with all its ramifications and details. Occupying abundant space in one of the loft buildings is a concern engaged in the manufacture of shredded cocoanut, say, which requires in its business large quantities of this well known nut of tropical growth. An expected consignment arrives by steamer at one of the piers. It is promptly discharged and immediately transferred to one of the neighboring warehouses for storage. When needed at the factory in the loft building the cocoanuts are hauled around by one of the electric engines and delivered. There, turned into that article of commerce known as shredded cocoanut, it is now ready for distribution in all the markets of the world. Some is packed to cover an order either in New York City or Brooklyn. It is therefore loaded on one of the motor trucks in the service of the terminal company and at once sent out for delivery that way. A carload order from San Francisco requires an empty for loading at the cocoanut company's platform, which is promptly furnished, there loaded, and hauled over to the float bridge, at which is awaiting a float bound for the Pennsylvania Railroad with other loaded cars. Waybilled by the terminal company, it is sent on its way without further consideration and arrives at destination in due course. Whether for Europe, South America or down East the shredded cocoanut or any other manufactured product is handled in the same way. At a glance one can readily appreciate what a marvellous convenience this method stands for, as compared with the usual method, where an industry is established in a city street a long distance from ship or rail connection. It is assuredly an innovation in freight terminals. Direct connection with every steamship line, railroad and express company whose business terminates in New York City and vicinity is established with the Bush Terminal. The business is growing rapidly, and the conveniences, facilities and economies offered have originated a never ending source of wonder that a plant of this sort had not been conceived and established long ago. W. L. Sturges, the general superintendent of the Bush Terminal, finds himself busy with the supervision of its affairs from early until late. A telephone at his bedside may even remind him in the dead of night that his judgment and prompt action are then absolutely necessary.



Electric Freight Locomotive.

Handling Freight at the Loft Building.

This plan shows the Piers, Yards, Warehouses and Loft Buildings. The Piers are about 1,500 ft. in length.

Convention of the Bridge and Building Association

The twenty-fifth annual convention of the American Railway Bridge and Building Association assembled Tuesday, October 19, 1915, at Hotel Statler, Detroit, Michigan. Mr. L. D. Hadwen, of the Chicago, Milwaukee & St. Paul, president of the association, called the meeting to order, and after an invocation by J. M. Pendwell, of the Lake Shore & Western, the association was welcomed by Mayor Mack of Detroit, and by John C. Bills, of the Pere Marquette, George W. Rear, of the Southern Pacific, and W. A. McGonagle, of the Duluth, Missabe & Northern, responding for the association.

President L. D. Hadwen in delivering his annual address, touched on the great changes that have been made both as to materials and methods employed in railway bridge and building work, calling attention to the increase in loading on railroad bridges and to the substitution of steel and even alloy steels for the wrought iron originally used in girder spans and trusses. He also mentioned the gradual disuse of the older forms of wooden bridges, and mentioned the open-floor pile bridge as another milepost, destined to be left behind in main line construction. He pointed out the change from the stone and rubble masonry that prevailed twenty years ago to the present use of concrete, which, with its lower cost both for material and labor has made possible immense railroad structures which could not otherwise have been built. He went on from this point to take up the gradual invasion of reinforced concrete in the fields formerly served by structural steel and other building material, and mentioned the use of reinforced concrete as a help in developing solid floor bridge construction with continuous ballasting across the structures. The great improvements in methods of handling material and equipment were mentioned, taking up specifically derrick cars and locomotive cranes, the mechanical appliances for mixing and placing concrete and other labor saving equipment. Grade separation has made possible terminal developments and other commercial projects which have not been possible without this feature.

LOCOMOTIVE CRANES.

In taking up the committee reports the first one submitted was on the subject of "Locomotive Cranes" presented by George W. Rear, chairman. This report went thoroughly into the historical development of locomotive cranes, and followed their growth to the present 60-ton capacity machines, which, with the possible use of outriggers and interchangeable boom equipment can be put to a variety of uses. Among these uses are switching of loaded and unloaded cars on construction work and in storage yards, thereby doing away with delays in waiting for switch engines; hoisting, within the capacity of the crane by means of either one or two lines, which, with boom extensions, can be used to place loads high above the crane; swinging, through a complete circle and with variable radius giving the crane a wide range of usefulness in loading and unloading cars and in placing material definitely; handling buckets by means of a double drum in connection with any two-line clam shell or orange peel bucket, making the crane desirable for handling ore, coal, gravel, etc.; handling scrap, when equipped with an electric generator and magnet, eliminating much of the cost of handling iron by hand; pile-driving, by means of a specially designed leader truss making the crane as effective as a regular pile driver with the added advantage of its full-circle swing for placing material; bridge and building construction, in which the crane can be used to switch the cars, unload the material, drive coffer-dams, excavate, drive foundation piles, handle concrete material, tear out old structure, clean up and load remaining material without other machinery, and with very few men; storage yards, where almost all varieties of work can be done more economically than by hand; roadway service, where the crane can be used for much work of a lighter nature than the heavy wrecking equipment.

Costs were presented, based on an average 20-ton to 30-ton capacity 8-wheel crane at an initial investment of $7,000 to $8,000, as follows:

	Per Day
Interest	$2.00
Depreciation	2.00
Repairs	2.00
Fuel	2.50
Supplies	.50
Labor	6.00
Total	$15.00

and this daily expense estimate is based on the crane remaining in service 200 full days a year for 20 years. No claim is made that a locomotive crane is more efficient in its own special field than a switch-engine, a stiff-legged derrick, a pile-driver or other special machine, but it is shown that the locomotive crane can do the work of all of these various equipments in a sufficiently efficient manner, where there is not enough work to advantageously employ all of the various machines, to make it a paying investment. From a large variety of sources averages have been made which would show that there are the following savings as against hand labor by the use of a locomotive crane:

	Per Day
Handling scrap or other material with magnet	$40.00
Handling coal and other material with a clam shell bucket	40.00
Handling lumber and timber	30.00
On general construction work including switching	40.00

Other units of saving were presented. Other advantages mentioned were speed of operation, reduced liability of personal injuries and versatility of the equipment. Recommendations were made as to the design of locomotive cranes both for general use and for special purposes.

The discussion brought out very interesting methods of using locomotive cranes for above purposes.

PILE AND FRAMED TRESTLE BRIDGES.

This report was introduced by A. B. McVay, of the Louisville & Nashville, and there was some discussion in regard to the sizes and placing of ties, and as to the methods of securing them against change of alignment, and to avoid rail creeping. Opinions seemed to be divided as to the advantages of dapping the ties over the stringers or of blocking between the ties under the guard timber, and each method had enthusiastic adherents. Satisfactory experiments with rerail castings were reported, and the convention seemed to agree that guard rails inside the track and guard timbers outside should be used.

WATER WASTE.

This report was presented by C. R. Knowles, of the Illinois Central, and was illustrated with lantern slides. It showed convincingly the savings that could be effected by eliminating the overflow when filling locomotive ten-

ders; the careless use of boiler washout hose; the direct use of hydrants for drinking purposes; the use of washing hose without nozzles; leaks in underground mains and other waste. In the discussion which followed J. S. Robertson, of the Chicago & Northwestern, reported that his company had inaugurated a system of inspection which was saving the road $24,000 worth of city water a year.

MANILA ROPE.

An illustrated paper was read by F. E. Weise, of the Chicago, Milwaukee & St. Paul, on the selection and use of Manila rope, in which the speaker went thoroughly into the elements which go to give maximum strength and long life, and to the methods of recognizing these qualities in the selection of rope.

RAILWAY WATER TANKS.

C. R. Knowles, chairman of the committee, reported that the present tendency toward the construction of large roadside tanks, which has in one case reached the unprecedented capacity of 200,000 gals., is introducing new problems in tank construction and maintenance. The use of these large tanks, particularly where a large number of engines take water in a limited time, or where night pumping can be eliminated, is found to be production of economy. Instances were cited where it is preferable to construct two or more tanks of medium size rather than one large one, so that water which is not to be used for locomotives need not be given expensive softening treatment. Mention was made of the fact that there are many advantages in favor of building these large permanent tanks at a sufficient distance from the tracks to permit of changes in track location and other construction features, which might be interfered with by the location of a large tank too near the track. In addition to this factor, such a tank delivering water through a penstock does not obstruct the view, affords better drainage and less trouble from soft track during summer and from ice in winter; is not so likely to strike trainmen, and affords less trouble on account of freezing goose-necks and valves.

Considerations governing the height of the tower or frame of the tank, the outlet pipe, the size of the delivery main, and the capacity of the tanks were treated at some length. A detailed comparison was prepared on the comparative life and the respective merits of wood and steel tanks, totals going to show that in 20 years a 20-ft. by 30-ft. wood tank would cost $6,737.68, while for the same length of time a 100,000-gallon steel tank would cost $4,645.10.

In the discussion which followed, various disadvantages arising from the use of steel or low grade wrought iron hoops for wooden tanks were mentioned, and the destructive corrosive action of certain water supplies was discussed.

METHODS OF HANDLING WORK AND MEN.

This report presented by G. W. Rear brought out in a most interesting manner the qualifications for mechanics and foremen employed in the bridge and building departments of railways and the development of designs and constructions that have reduced the amount of hand labor. The introduction of labor-saving devices, including power concrete mixers, automatic riveters, motor cars and ball bearing bridge jacks was described.

PROTECTION OF GRADE CROSSINGS.

E. C. Morrison, chairman of the committee, presented a report on the protection of grade crossings, in which were discussed the different forms of crossing protection best adapted to various stations. The conflict of authority between civic, county or state authorities in attempts to determine the methods of protection often causes a railroad to install protection which it considers to be less efficient and more expensive than another type. Designs of crossing signs and location of whistling posts were discussed, as well as the necessity for keeping the roadway at railway crossings in good condition. The use of gates was recommended only for one or two track crossings where traffic is not greatly congested. Various forms of barrier crossing protection were described and various experiments in these barriers, with the conclusion that white made the best color. The use of automatic gates was discouraged. Flagmen are recommended wherever traffic is heavy or a large number of tracks have to be crossed. Automatic flagmen serve a good purpose under some conditions, and these wigwag signals, averaging in cost from $300 to $500, are looked on with favor. Averages of a number of observations showed less than 25 per cent. of the public, in crossing railroad tracks, pay any attention either by slowing, stopping, or looking up or down the track, to the effect that there is no danger connected with crossing a railroad track. It is recommended that where feasible grade crossings be eliminated, that obscure crossings be opened up to view by removing trees, brushes, buildings, etc., that roadways at track crossings be maintained in the best possible condition, that wigwag signals, gates or flagmen be provided as local conditions require, and that all means possible should be used to induce the public to observe due caution at grade crossings.

ELECTION OF OFFICERS.

The election of officers resulted in the selection of the following gentlemen: President, Geo. W. Rear, Southern Pacific Co.; first vice-president, C. E. Smith, consulting engineer, St. Louis, Mo.; second vice-president, E. B. Ashby, Lehigh Valley R. R.; third vice-president, S. C. Tanner, Baltimore & Ohio R. R.; fourth vice-president, Lee Jutton, Chicago & Northwestern Ry.; secretary, C. A. Lichty, Chicago & Northwestern Ry.; treasurer, E. S. Meloy, Chicago, Milwaukee & St. Paul Ry. Members of executive committee: F. E. Weise, C. M. & St. P. Ry.; W. F. Strouse, B. & O. R. R.; C. R. Knowles, Illinois Central R. R.; A. Ridgeway, Denver & Rio Grande R. R.; J. S. Robinson, C. & N. W. Ry.; and J. P. Wood, Pere Marquette R. R.

The committee on membership reported ninety applicants, all of whom were acted upon favorably, bringing the present membership of the Association up to 659.

REGULATION OF WATER POWERS

One of the most important problems in the political economy of a nation is the control of water power, says a recent commerce report. It is usually helpful, in considering the conditions involved in this problem, to find how other countries have dealt with somewhat similar conditions, so that Water-Supply Paper 238—The Public Utility of Water Powers and their Governmental Regulations—issued by the United States Geological Survey in 1910, contains much valuable data. This report, in conjunction with the United States Geological Survey, treats of the manner in which France, Switzerland and Italy have dealt with the problem. The French regulations take cognizance of two kinds of streams—first, rivers that are navigable neither for vessels nor rafts, and second, streams that are navigable by vessels or rafts, which lie within the public domain. In Switzerland control of water courses that are navigable for neither ships nor rafts is retained by the cantons and communes; in Italy the waters are public property, concessions for development being issued by the Government. A copy of the report may be obtained free on application to the Director of the United States Geological Survey, Washington, D. C.

MECHANICAL TAMPING OF TIES IN FRANCE

It is essential that, in the proper tamping of railway ties, the ballast should be packed, not only under the center of the tie, but that it should be equally solid from the center to the edges. Heretofore this work has been performed without the aid of mechanical appliances, other than the usual hand-tamping implements. This method, practically the universal practice, is slow and requires the employment of a large number of men.

Many efforts have been made to provide mechanical appliances, as Mr. George W. Vaughan, engineer of maintenance of way in the N. Y. C., tells us in a paper on "Ballast Tampers for Railway Ties," contributed to the American Railway Engineering Association. The work done by these machines was somewhat defective, or too many men were required, and therefore the power-driven rammers have not met with much favor.

The apparatus heretofore available was heavy and cumbersome and it has been proposed to mount the tool on mechanical supports. Apparatus of this kind, attached to the track or to a truck adapted to run on the track, was a failure owing to the difficulty in setting it laterally or along the tie at the proper angle. Such apparatus tends to interfere with the movement of trains, and it must be capable of being readily lifted off and on the track.

Previous to 1913 the only practical machine of this kind was invented and patented by Albert Collet, of Paris. This tamping machine was driven by a gasoline motor. It had two tanks, one for gasoline and one for water, and could run for ten days. The truck had six wheels, a large pair in the center and a small pair at each end. The action of a crank enabled one man to cause the whole system to rest alternately on the big or little wheels, the small ones being able to turn through an angle of 90 degs. It was, therefore, easy to remove from the track by the use of short rail lengths, placed perpendicularly to the line under the small wheels. When the weight was applied to them, and the large wheels freed, the machine could easily be moved off the track. The operation occupied five minutes.

To convey the electric current generated by this apparatus, an electric line was provided, carried on ladder insulated supports. These require 160 ft. of high-conductivity copper wires, making a pair. Two trained men can place twenty-five of these supports in a day. That covers 4,100 ft. of railway track. The ladders can be used to support electric lamps to give light on the work. The weight of one of these insulating supports is about 116 lbs. The current is therefore carried to a motor on a small truck. The whole of this apparatus can be quickly taken to pieces on the rails.

The packer or tamping tool is actuated by the electric current and enables rapid packing to be done in the ballast, of whatever kind it may be. The inclination of the packer facilitates the work, as the packing at the bottom is done first and the tool is brought gradually up toward the surface. This insures equal compactness all through. The result is uniformity in the foundation of the road. The work done per minute corresponds to that of 400 blows produced by the release of a spring of 440 lbs., enclosed in the head of the machine.

A mechanical-packed road allows the movement of trains at full speed to be resumed immediately the work is done and eliminates the necessity for slow orders and other delays. The work done by two sets of four packers each is from 60 to 100 ties an hour, according to the thickness and kind of ballast. Packers are made to suit service in different kinds of ballast, and are easily substituted, the one for the other.

A test of these machines was made on the Eastern Railway of France. It took place between Paris and Rheims. The work consisted of repairing 4.58 miles of track and the renewal of ballast and also track repairs on 4.9 miles. In the ballast renewal work the men were grouped into three gangs. The first exposed the track and removed the ballast. The second unloaded the ballast. The third gang tamped the ballast with Collet machines and surfaced the track. Two kinds of tamping tools were tried. One set had round faces, each 4.72 ins. in diameter, and the other had rectangular faces of about the same area. The square tools were best for sawed ties and the round ones for joint ties. After some experience with the tools the faces which strike the ballast were inclined so as to give a more horizontal impact.

The density of the ballast as obtained by these machines, and uniformity of the tamping were carefully observed all through the work. The conclusions drawn from the entire experiment were that mechanical tamping does not raise the track. The settling of the track after about 150 trains had passed over it was less than ¼ of an inch. More trains did not produce any appreciable effect and the settling appeared to have stopped. No difference was shown in the settling of the track at the joints and at the middle of the rail. The settling of hand-tamped ballast was not uniform, and was greater than with machine-tamped ballast.

The machine and its work presents some interesting items of cost. The machine itself is worth about $7,800. The cost of the work was about 12 cents a ft., as against 11 and 11½ cents a ft. hand work. Even if direct economy is not at once realized by the machine, it does not follow that lower costs are impossible. If extensively used it is more than probable the machine could be still further improved or more efficiently worked. In any case there are a number of advantages to be had with the machine which would no doubt compensate for a slightly higher cost. There is, for example, greater security and better work done by the machine than is usual with hand work, and there is guarantee against subsequent deformation, which deformation, when it takes place, must be made good by subsequent maintenance work, and this cost must be taken into consideration.

Some further conclusions are added toward the end of the paper. Mechanical tamping, as has been said, does not raise the track, but gives it a base which is ordinarily obtained only after the passage of a large number of trains. Without increase of expense, the length of time necessary for making repairs can be decreased by one-third. The length of slow-speed track can be very appreciably reduced, and normal track restored in less than 24 hrs. The tools are ballast packers rather than tampers, in that they press the ballast up against the ties, instead of tamping it under the tie as is usually the case with hand work. Owing to the tendency to drive the ballast down into the subgrade and the wide spacing of ties, this machine does not seem to be suitable for work on American railways, where the ties are spaced closed together.

Next month we hope to continue the digest of this valuable paper and show the result of some tests made with air-operated tools on the New York Central Railroad.

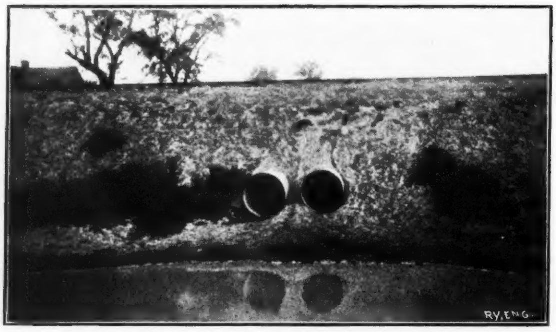
There is assuredly no action of our social life, however unimportant, which by kindly thought may not be made to have a beneficial influence upon others.—*Lectures on Architecture and Painting.*

The Minneapolis & St. Louis R. R. proposes to construct bridges over grade crossings at Jackson's Crossing, Glen Lake, Clear Springs and Glen Morris, near Minneapolis, Minn.

PURE IRON CORRUGATED CULVERTS

One of the interesting developments in railway construction and maintenance is the use of corrugated culvert pipe made from what is practically pure iron. The amount of evidence on the comparatively high resistance to corrosion afforded by iron from which impurities have been almost wholly excluded, shows a very satisfactory state of affairs.

Briefly, the contention is that rust and corrosion arise from electro-chemical processes substantially similar to those of the galvanic battery or voltaic cell, and depend upon the exposure of two metals or other substances of varying electric capacities to moisture or to the oxygen of the air. Any substance differing electro-chemically from iron and exposed on the surface of a sheet or plate of iron gives opportunity for the formation of a galvanic couple and, therefore, produces the corrosion of the iron.



Double culvert in bank

The existence of a commercial form of iron which is practically free from impurities has made it possible to construct pipes of relatively thin plates with assurance of reasonable permanence. The corrugated form and overlapping joints of this type of construction result in a very remarkable increase of strength over that of a plain cylindrical type and also in other advantages in practice. The pipe is quite capable of giving and bending when in a shifting or settling embankment, without suffering serious injury. Many of these pipes are in use where sinking has taken place to a very great extent, and they are still giving good service and seem likely to continue so doing for a long time yet to come. This is, of course, an important superiority to the rigid form of construction.

The corrugations of the pipe enable it to take up expansion and contraction arising from temperature changes. A very curious fact with regard to this form of pipe is that it clears itself from silt or other obstructions better than smooth pipe does. This statement might be deemed incredible if it were not for the fact that it has been proved many times where the pipe has been used in the form of inverted siphons. Of these there are a great many in the Southwest, where keeping them clear from silt is a very important matter. The explanation seems to be that the corrugations produce ripples in the flowing water and these keep the silt in suspension so that it may pass through the pipe. A natural condition somewhat parallel to this is found in the beds of streams. If these are rough and stony, the water is, therefore, constantly riled, and there is little or no deposit of mud. In the smooth stretches, however, where the only motion of the water is due to the current, mud rapidly accumulates.

Some of the railroads that have made extensive use of Armco corrugated pipe are the Western Pacific, the Northwestern Pacific, the Soo Line and the Southern. The Pennsylvania has one 12-in. corrugated culvert under the four tracks of its main line near Marsh Run, where it has been in service under perhaps the heaviest railroad traffic in the United States for a period of from 6 to 7 years and which appears to be in practically thoroughly good condition. In Central and South America and various portions of the Orient, this type of culvert is extensively employed because of its lightness, ease of installation and practical certainty of obtaining good results under more or less difficult conditions.

The Pennsylvania R. R. on September 11 began operating by an overhead electric system four passenger trains daily on its main line between Broad Street, Philadelpria, and Paoli, 20 miles. The total cost of electrifying these 20 miles is unofficially stated as about $4,000,000. This service will be gradually increased. Electric current is obtained from the Philadelphia Electric Co. The Chester Hill branch, it is reported, will be the next line to be equipped electrically.

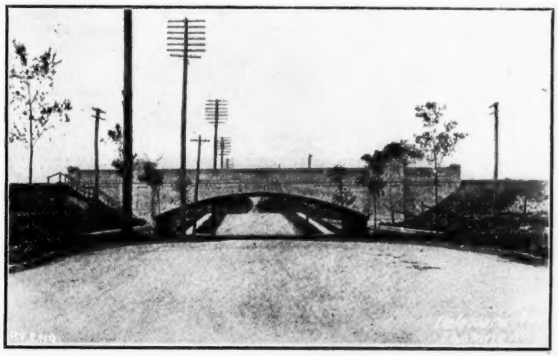
Advices from Philadelphia state that fast through electric car service between Philadelphia, Valley Forge, Phoenixville, Spring City and Pottstown is probable within a year, the Philadelphia & Western Ry. to form the terminal trunk line, but to take no part in financing the plan which is now being worked out by strong Philadelphia interests. Newspaper reports have it that the plan contemplates a 7-mile extension of the Phoenixville Valley Forge & Strafford Electric Ry. to a connection with the Philadelphia & Western at Bridgeport. This work and new cars such as the Philadelphia & Western would be willing to attach to its train will cost, as estimated about $300,000. With these lines joined up new fast electric service will be provided through a territory inhabited by about 40,000 persons, affording Philadelphia easier access from thriving towns 30 miles up the Schuylkill River and giving a frequent service out to Valley Forge Park.

Corrugated culvert with concrete face

The electrification of the main line of the Chicago, Milwaukee & St. Paul Ry., between Three Forks and Deer Lodge, Mont., 113 miles, which has been proceeding all summer, is approaching completion. It is proposed to make tests of the locomotive equipment early in October between Lombard and Three Forks. This part of the road has some of the heaviest grades encountered on the division. A total of 21 electric locomotives have been ordered for this service, of which the initial oder of 12 are to be used between Three Forks and Deer Lodge, and the remainder on the parts to be electrified later, embracing 440 miles of line, between Harlowton, Mont., and Avery, Idaho. Each locomotive weighs 260 tons, and is equipped with 8 motors, having a capacity of 3,000 h. p.

Grade Crossing Elimination at Buffalo

The work of eliminating grade crossings on the New York Central Lines at Buffalo, N. Y., is in line with the growing desire all over the country for the preservation of human life. One of the features of this tendency of thought and action is not so much to rely on the old time



Concrete Bridge for Railway with Depressed Roadway.

warning devices as to prevent persons and vehicles from even entering the danger zone.

The work of doing away with grade crossings of city streets and railway tracks at Buffalo involved a revision of grade and the abolition of twenty-three street crossings. The work was carried out in accordance with agreement entered into between the N. Y. C. Railroad Company and the Grade Crossing Commission of the city, the former

Concrete Bridge Carrying Railway; N. Y. C. Lines.

constructing all the bridges and the latter doing all work in connection with pavements, sidewalks, retaining walls on approaches. Each paid a certain proportion of the entire cost of all work in connection with elimination.

Taking a typical example, that of Delaware Avenue, the bridge put up here to carry the railroad tracks is ostensibly a flat concrete arch; it is in realty composed of steel arch ribs 2 ft. $1\frac{3}{4}$ ins. centers, encased in concrete. This is a four-track structure, 68 ft. 6 ins. between abutments, with an 8-ft. rise. Reinforced concrete arches are incorporated between the arch ribs and transverse arches are built up to the track grade. A minimum of 14 ft. under clearance is provided for, $6\frac{1}{2}$ ft. about the center line of the street, decreasing to 12 ft. from top of curb; $\frac{1}{2}$ in. membranous waterproofing is applied to the bridge floor, protected by a course of hard burned brick. A reinforced concrete railing completes the structure. The design for the Parkside Avenue is the same as at Delaware Avenue, the span and other dimensions being of course less in proportion.

The Amherst Street bridge, like the other bridges described, is a four-track structure and is 70 ft. $5\frac{1}{4}$ ins. between abutments, with an underclearance of 21 ft. 6 ins. to the base of the rail. It consists of two cantilever trusses supporting a suspended span, the ends of which are indicated by the expansion joints shown in our illustration. The steel is encased in cinder concrete, being finished with 1 in. of face mortar. The floor is waterproofed with $\frac{1}{4}$ in. straight run coal tar, on which is placed a 1-in. sand cushion for stone block pavement.

The design of the bridge at Main Street is the same as the Amherst Street bridge, the distance between abutments being, however, 93 ft. 4 ins., due to the greater skew of the crossing. The other bridges are reinforced con-

Concrete Roadway Bridge; N. Y. C. Lines.

crete arches, one of which is described below. It is the Leroy Avenue bridge, and is a reinforced concrete arch with a span of 58 ft. 11 ins. and rise of 8 ft. 8 ins. The thickness at the crown is 22 ft. and 4 ins. at the spring line. The longitudinal reinforcing consists of $\frac{3}{4}$-in. square bars, 12 ins. center to center, in the top and bottom, under sidewalks, and 1-in. square bars, with the same spacing, under the roadway. The transverse rods are $\frac{3}{4}$ in. square, spaced 4 ins. center to center, in the top and bottom, staggered. The arch is waterproofed with

Concrete Bridges for City Streets; N. Y. C. Lines.

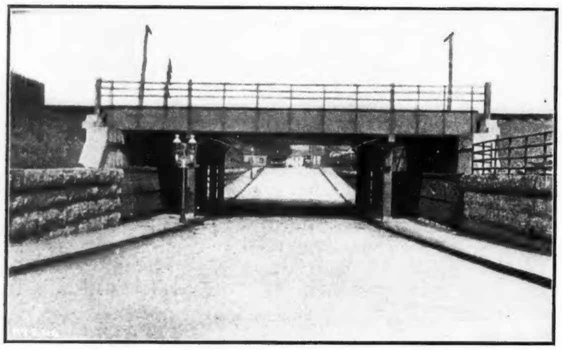
$\frac{1}{8}$-in. straight run coal tar and one layer of waterproofing felt, covered with 1 in. of 1.2 cement mortar. The backfill is made of cinders to the subgrade of the street. The abutments are about 2 ft. thick, being anchored to the face of the rock cut. The haunches of the arch are

set back on a bench in the rock. At this point a 36-in. water main was encountered in the center of the street, which is carried over the bridge in a reinforced concrete box. Traffic is protected, at night, against this unavoidable obstruction by two street lamps, placed at each end of the

City Streets Over Railway Tracks; N. Y. C. Lines.

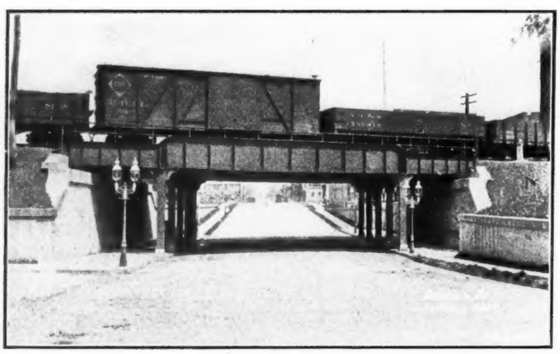
box. This structure, as well as those previously described, is in the Central Park district, which is a high class residential section, and it is for this reason that the various designs are more elaborate than they otherwise would be.

There is a three-span, through plate bridge, with a solid floor, I-beams and concrete slab placed at Delevan



Steel Bridge Carrying Railway; N. Y. C. Lines.

Avenue. The distance between the abutments is 73 ft. 5 ins. with a 14-ft. underclearance. This clearance is provided instead of 13 ft., wherever the street railway has a franchise. The concrete slab is 5 ins. thick, covered by ½-in. membranous waterproofing, which is protected by a course of hard burned brick.



Steel Bridge Carrying Railway; N. Y. C. Lines.

At Fougeron Street there is a three-span bridge with plate and I-beam floor, cross girders and columns. The distance between abutments is 51 ft. 10 ins., the underclearance being 13 ft. The deck plates are covered by reinforced concrete slabs 1⅛ ins. thick at the drainage nipples, the surface having a rise of ⅛ in. per foot away from the nipples, for drainage. This is covered by membranous waterproofing, which is protected by a course of brick. The maximum thickness of waterproofing is 4½ ins., measured from the top of deck plate. The cut stone retaining walls, constructed by the city of Buffalo, are built well into the street to lessen the damage to adjacent property. It is interesting to note the iron fence connecting the ends of the walls. The recesses formed by the walls and abutments afforded convenient cover for lawless persons who frequently congregate in this district, and it was therefore necessary to put up fences to prevent unwary pedestrians from being attacked or otherwise taken by surprise.

The entire work occupied about five years, and included, besides the elimination work, the making of a

Railroad as it Appears on Top of Concrete Bridge.

four-track cut entirely through the rock. The maximum depth of this was about 28 ft. The bulk of the excavated material was used in the fills. The completion of this work marks the passing of practically all the dangerous grade crossings of the N. Y. C. in Buffalo, with the exception of two in the Black Rock Yard. The work on these will undoubtedly be started in the near future. In thus carrying out work of making the city streets safe for foot passengers and vehicles of all kinds, the railway has incurred expense on a large scale, but this must, in the judgment of those best qualified to realize the importance of the work, remain a secondary matter where the value of human life is properly appreciated.

The candid explanation offered by Pres. H. H. Westinghouse to his board of directors covering reasons which influenced the acceptance of a munition contract by the Westinghouse Air Brake Company is of more than passing interest. Patriotism is reflected in the company's belief that at this time a state of preparedness should be established by some of the larger manufacturing concerns in the United States through the erection of proper buildings, installation of suitable machinery and the development of ordnance engineering experts, which would efficiently serve the United States Government in case of sudden need of war munition. Philanthropic purpose is prominent in the company's desire to avoid the recurrence of hardships suffered by its employees last winter through an unavoidable reduction in its working force because of slack air brake business. Such thoughtfulness indicates strongly and creditably the genuine interestedness of the company in the welfare of its employees.

The nobleness of life depends upon its consistency, clearness of purpose, quiet and ceaseless energy.—*The Ethics of the Dust.*

PROGRAM OF WORK

By W. H. Haney, Track Foreman.

General improvements such as tile drainage, reballasting, etc., can best be carried on from late spring to late autumn. All such work, however, should be planned and arranged beforehand so that the track may not be disturbed for reballasting just after the section gang has completed a thorough surfacing. Work trains and floating gangs for ditching, ballasting, widening cuts, etc., and special gangs on new interlocking plants, rearrangement of yards, repairing or building structures, etc., may carry on such work at any time from the end of one winter to the beginning of the next.

For the ordinary work on the sections no set rules or gram of procedure can be formulated, as the requirements vary in different sections of the country. In general, however, the year may be divided into four seasons.

SPRING WORK—The first thing to do in the spring as soon as the frost is out of the ground and there is no more likelihood of snow, is to remove the shims from the track gradually. The frost will of course remain longer in the roadbed in cuts than on exposed banks. The low joints must be raised, spikes driven, bolts tightened, cattle guards and road crossings cleared and repaired, ditches cleaned, fences repaired, portable snow fences taken down and piled, rubbish and old material cleared from the right of way and the necessary lining and surfacing done to put the track in good condition

This is all preliminary to the more extensive work to be done later in the season At the same time sign posts and telegraph poles should be straightened, and side tracks and yards overhauled The gang if not already increased is filled out to the maximum number and the work of removing ties is commenced, the ties having been previously distributed on the section. About four days a week should be spent in putting in the ties, all of which should be fully tamped as soon as they are in place. The other two days should be spent on other necessary work. On some roads the tie renewals are made quickly at the beginning of the season, while on others this work is spread through the season. The former is by far the better plan, as the continued disturbance resulting from distributing the work over the whole year is very detrimental to good track maintenance. When the ties are all in the work of thorough lining and surfacing and preparations for the heavy summer traffic is commenced.

The lining is done first on account of the bad line resulting from tie reenwals, but the surfacing should follow very closely and the gaging should be done at the same time. Ballasting is done after the new ties have been put in and in surfacing the trackmen should not raise the track too high, but just enough to give a uniform surface, the track only being raised out of face about once in four or five years.

SUMMER WORK—Rail renewals can be underetaken at any time between spring and winter. The new rails are sometimes laid before the ties are renewed, but it is better to put in the ties first and have them thoroughly tamped up, especially if there are many bad ties. A general inspection of spikes, bolts, nuts and nutlocks is then to be made, all worn, bent, broken or improperly driven spikes to be removed, the holes plugged and new spikes driven. Broken or loose bolts should be replaced. Switches and switch connections, frogs, guard rails, etc., should be carefully inspected and repaired as the regular surfacing is carried along. As the regular surfacing is completed the ballast should be dressed to the standard cross section and the toe of the slope lined to a grass line, about 5 ft. 6 in. from the rail.

Tile drainage, straightening up signs and general work not interfering with the track itself can best be done during the summer. Spare time can also be spent in trimming up yard tracks and clearing yards and station grounds.

FALL WORK—Weeds should be cut at least once a year and the best time for this is just before seeding. The grass on the right of way should be mowed, bushes cleared and trimmed, and in cases where fires cause trouble a fire guard may be formed by plowing a narrow strip about 50 ft. on each side of the track. Burnt or decayed trees likely to fall near the track should also be removed and the dry brush, old ties, etc., should be burned. Old material should also be cleared up. About a month before the commencement of the winter or rainy season, a general surfacing, lining, gaging and dressing of the track should be commenced, starting at the further end of the section and working steadily toward the other end.

The track itself should be put in good condition at the same time and spikes and joints looked after. When this is done ditching may be undertaken, the ditches being cleaned out and improved where necessary to give the proper width and grade. The more thoroughly this work is done the better the track will stand the winter conditions. Trenches should also be cut under the switch rods to prevent water or snow collecting around them and freezing. The culverts and waterways must be cleared of brush and obstructions and any signs of scour or undermining looked after, while streams should be examined above and below the culverts and obstructions removed.

There is still plenty of work to be done in cutting and burning weeds, repairing fences, repairing and erecting snow fences and stacking additional portable snow fences where they will be needed.

Track signs and telegraph poles have to be inspected and cattle guards and crossings cleaned up. Yards and side tracks should also be cleaned, drained, leveled up and repaired before the snow falls.

WINTER WORK—The winter work with reduced track forces is largely that of inspecting the track and making small repairs, also looking after the spikes, bolts, frogs and switches. Such work will occupy the time between snow storms or in fine weather. During the snow storms the switches, frogs and guard rail flangeways must be kept clear, as must also all signal and interlocking connections. Salt is used to melt the snow but oil afterwards should be applied to all moving parts, such as slide plates, ball crank levers, etc., as the salt water has a tendency to rust the iron, making the parts move hard.

In heavy snow storms the section men must work at clearing the track and helping the snow gang or shovelers. In the intervals of fine weather, rails, ties, lumber, fence material, etc., may be distributed ready for the spring and summer work. Heaving of the track on account of frost must be expected and proper precautions must be taken to keep the track in surface by shimming, while in very bad places blocking may be necessary. The ditches should be examined as soon as any thaw sets in and kept clear of ice or packed snow, so as to allow free passage for the water.

On the Norfolk & Western

By W. R. Dawson, Assistant to the Genera Manager.

The trackmen for the Norfolk & Western are obtained from the cities of Norfolk, Va.; Columbus and Cincinnati, O., and for the Winston-Salem division they are hired between Winston-Salem and Roanoke, in the states of Virginia and North Carolina.

Track laborers are hired by the boarding contractor,

who has labor agents working at points either on our line or in close proximity thereto in Virginia, West Virginia, North Carolina, Tennessee and Ohio. We do not have employes of the railway company to accept shipments of men until they have been delivered to the gangs at the points where they are employed to work. We have no company labor bureau. The extra force labor is cut down as far as practicable and section forces the reduced through the winter months.

Track laborers on extra forces are provided with shanties in some instances, but generally with camp cars, and the same is true of bridge forces. Each section foreman is furnished with a comfortable dwelling for himself and family at his headquarters, and in addition generally has a two-room house furnished for the laborers. However, a large percentage of the section laborers on the system rent from individuals, but in some cases own their own homes. Section laborers can draw rations and other supplies from the boarding contractor if they so desire.

No inducements are offered to the men to hold them on the road other than comfortable quarters for taking care of the men and free transportation to and from their homes for those who live off the work and for the men who wish to go away on a vacation.

Track laborers are generally promoted from the section and extra forces, promotion being based on ability, sobriety, length of service and the knack or gift of handling men on the gangs from which they are promoted. This is based somewhat upon the recommendation by the foreman under which they have worked directly, together with the personal knowledge the roadmasters have of such men.

The only instruction we give the laborers is that obtained through actual experience on the track gangs.

Laborers on sections are generally employed by the foremen. On extra forces laborers are employed by the foreman of the gangs when laborers are available, and in the event they are not, the boarding contractor sends out labor agents. Assistant extra gang foremen and section foremen are selected from laborers who have served five years or more. Roadmasters examine these men in a general way on the rules and complicated track work before they are promoted.

The reliability of the trackmen's organization has been improved materially by advancing young, sober men from the ranks who have proven efficient and loyal in their former duties. We believe that a continuation of these methods will result in a progressive, well balanced organization.

AN UNFORTUNATE RAILROAD PROJECT.

There was only one man who could build a railroad without money and without credit and make it pay. He is dead.

An interesting example of the mistakes which are sometimes made by promoters who have an idea that a railroad will be successful, wherever it may be built, and however financed, is presented in the case of the Atlantic and Southern—thirty-seven miles long, running from Atlantic to Villisca in the State of Iowa.

It was built in 1910 with money which was to be raised by taxation, and money and services to be furnished by the people who lived along the proposed line. The people were to receive bonds, as soon as the road was finished. Contractors and enterprising citizens who contributed right of way were to receive bonds for their interest also. Material furnished and work for the necessary grading were likewise to be covered by bonds. The credit system was in vogue in its most extended form. When the tax collector called on the once hopeful farmers to pay the assessments levied on account of this public utility they objected to its payment; called on the courts for relief and secured an injunction restraining the county treasurer from paying out any money which might have been collected, and restraining the collector from making any more collections. The graders and other parties in interest placed a lien on the property in turn, and following this everybody with a claim did the same thing, until a receiver came into control to complete the handicap. Eventually, under a court order, the railroad was sold. The buyers, at the sale, made serious efforts to raise the necessary funds to make the payment and failed. An extension of time was granted to aid them. They failed again to meet their engagement, and several other extensions were granted, also without results, so that the sale was finally cancelled. A second sale, which had been ordered, found the same buyers on hand once more. This time their bid was so low that it was flatly rejected, and another sale was ordered. On this occasion the bond holders on one end of the system bid in that much of the railroad and the claim holders on the other end bid in that portion. The bond holders' end lay dormant and unopened, but the other end, controlled by the claim holders, representing a corporation with only 300 directors—the size of the road did not warrant any more—began operations in August, 1913. It soon became apparent that it did not pay to operate it. The track had never been ballasted; the rails were full of kinks; business was shamefully bad, and the cost of maintenance heavy, so that the owners ran the last train on Dec. 31st, 1914, and closed operations altogether.

Now the people who wanted the railroad and later turned about to assist in its downfall called upon the Railroad Commissioners of the State to order the owners to operate the road, whether it paid or not, and such an order has at last been issued to take effect January 1st, 1916.

Thus we see upon what a flimsy basis, sometimes, a railroad is projected. The public, like individuals, are likely to be fickle on occasion, and may turn from one extreme to another, as they have in this instance. Railroad building in these days requires much careful consideration to insure success and the necessary support. The bond holders were wise. They never opened their end of the line, and its prospective patrons were not therefor in position to demand its operation. It had never been dedicated to public use.

INDUSTRIAL OIL SWITCH

An improved type of oil switch is now used extensively in industrial establishments to control and protect induction motors up to 2,500 volts and 300 amperes. It can be mounted on a wall, post or other vertical flat surface, or by means of suitable supports on the machine operated by the motor. The switch is made by the General Electric Company in both non-automatic and automatic forms; the first simply to start and stop the motor, and the second to cut off current from the motor automatically on the occurrence of an overload greater than that for which the overload trip is set.

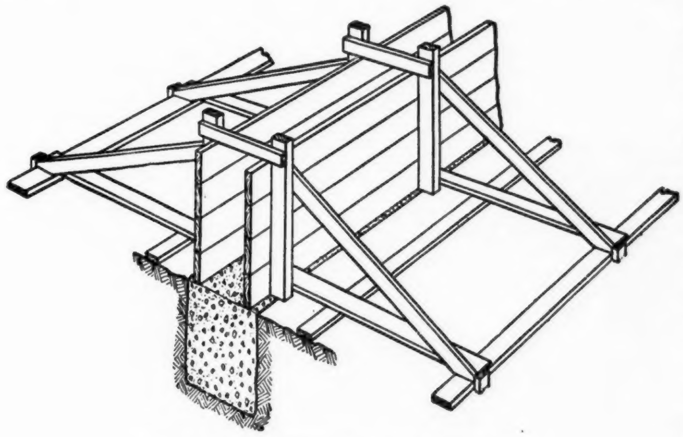
Through a recent improvement in the design of the mechanism, a low-voltage trip can be added to the automatic switch as an attachment at any time. To the non-automatic switch, either a low-voltage trip or a series-overload trip, or both, can be added whenever desired. Both means of tripping are mounted inside the switch cover. The use of the new auto-transformer, or voltage transformer, makes the watts loss in the low-voltage device practically negligible.

On the switch with the time limit-overload trip, the calibrating tubes and dash pots are protected from injury by a cast-iron guard which has been added.

SIMPLE CONCRETE WALL CONSTRUCTION

Concrete walls are easily constructed. These walls are especially suitable for entrances or other work required on railways, and it is not necessary to construct the wall more than 6 ins. thick. The most important consideration in the construction of any wall is a firm foundation, sufficiently deep to prevent heaving by frost. In most localities this distance is 3 to 4 ft. When the earth is firm and the sides of an excavation will stand up vertically, it is unnecessary to use wooden forms for the portion of wall beneath ground level.

A trench of the required width is dug, the sides of the trench should be straight, vertical and fairly smooth. The width of all walls below ground level may be 12 ins. Where sandy or crumbly earth is encountered, it is best to use wooden forms below ground level. In depositing the concrete in the foundation trench earth should not be permitted to fall into it, as it would weaken the wall. The proper proportions for walls below ground are 1 bag of Portland cement to 2½ cu. ft. of sand to 5 cu. ft. of crushed rock or pebbles. When the trench is filled with concrete to ground level, a simple form, as shown in our illustration, is set in place. The surface of the foundation at the ground level must be entirely free from earth, or other foreign substances and the concrete rough-



Simple Form Construction for Concrete Walls.

ened before depositing upon it. The minimum thickness of walls for very light structures may be 4 ins., although it is difficult to deposit concrete in a wall as thin as this.

A thickness of 6 ins. is better for most purposes. The proportion of walls above ground should be 1 bag of Portland cement to 2 cu. ft. of sand to 4 cu. ft. of crushed rock or pebbles. Bank-run gravel may be used if the pebbles are separated from the sand by screening through a ¼-in. screen. For the above ground portion of walls the forms should be made carefully, the boards being carefully matched so that a smooth surface will be obtained in the finished wall. This result is obtained by spading the concrete as it is being placed in the forms. Spading consists of thrusting between the form and the fresh concrete a thin wooden paddle. This serves to force the stone back into the concrete, allowing a rich mortar coat to flow against the forms. In walls above ground it is well to reinforce it, using small steel rods or wire mesh. This reinforcing runs in both directions and serves to prevent any cracks due to settlement or other causes.

Walls for buildings can be constructed as described, but for buildings of considerable size the thickness of the walls should be 8 ins. and one or two lengths of rods should be laid about 2 ins. above the tops of windows, doors and other openings.

EQUIPMENT TRUST CERTIFICATES.

The Public Service Commission have authorized the issue by the Binghamton Railway Co. of $90,000 equipment trust certificates, with which the company will finance the purchase of twenty new double-truck, all-steel cars. Seven of the cars will be 30 ft. over the corner posts and 42 ft. over the buffers, and the remaining thirteen will be 25 .ft. over the corner posts and 37 ft. over the buffers. The cars will cost $118,503 in all. Of this amount the company will pay $28,503 in cash. The equipment trust is negotiated with E. H. York of Philadeplhia and with the Pennsylvania Company for Insurance on Lives and Granting Annuities. The certificates bear interest at 6 per cent. and mature semi-annually.

INCREASED FACILITIES

Enlarged freight facilities have recently been provided in Pittsburgh, Pa., by the Baltimore & Ohio Railroad by the opening of a modern warehouse for the storage of general merchandise. The building is situated at Second Avenue and Try Street. The warehouse, seven stories high, with additional floor space below the level of the street, is of brick and reinforced concrete, thus gaining low insurance rates. Each floor has windows on all four sides and is well lighted, and can also be well ventilated. Commodious elevator service has been provided. The building is adapted to the storage and handling of all food stuffs, except perishable freight requiring cold storage. While cold storage has not been provided, the basement has a fairly low temperature, good for certain products. This terminal is within a half block of the Baltimore & Ohio Pittsburgh freight station, at Grant and Water street. It is connected by tracks to the freight station, and affords easy interchange for the distribution and reforwarding of merchandise.

MINNEAPOLIS, ST. PAUL & SAULT STE MARIE RAILWAY CO.

The report of this company for the year ended June 30 last shows that the gross earnings of the entire system decreased $1,542,997.50 and the net earnings only $112.90. The surplus income decreased $260,462.26. Maintenance expense decreased $904,685.14. The transportation expense decreased $466,075.90. For additions and betterments there were expended $723,829.64. The statement which is very full and complete shows to what extent the general business depression has affected the property. Like other lines it has required skill and careful attention to handle the situation. As stated by its president the Northwestern States are blessed with an excellent grain crop this year, which should bring about substantial increases in tonnage. With a general revival in business the results for the coming year should show decided improvement. The property is in condition to economically handle a largely increased business.

The Roberts and Schaefer Company were awarded a contract on September 8th, by the Louisville & Nashville Railroad for a large automatic electric coal handling equipment for Pensacola, Florida.

PROTECTING STEEL SURFACES

By A. W. Hoffmann, Associate Am. Soc. C.E.

The life of a steel structure depends largely on the protection from rust, gases and other destructive influences, especially if there is practically no excess of material in the structure. The measures of protection come either under the heading of maintenance or of construction.

Even the best coat of protective paint lasts only a few years, and before the end of that time it must be renewed to give the structure another lease of life. Careful inspection is necessary to locate weak spots in the coat of paint. Of course, the first cost of painting is relatively low, and it does not add to the weight of the structure.

A more permanent way to protect the surfaces of a steel structure is the encasing in concrete. This is a part of the construction of the bridge, and is reasonably permanent, and requires practically no maintenance. The first cost is, however, great, not only of the concrete casing itself, but also of the additional steel required on account of the weight of the concrete.

It seems reasonable to assume that, on the other hand, the concrete casing adds to the strength of the structure, or permits the use of higher stresses in the steel. It is a question of economy whether the saving in weight, owing to higher stresses, offsets the increased amount of steel, caused by the increased dead load. Concrete encasing should in all cases be so designed as to prevent cracks which might, by gradually opening up, expose the steel surface to atmospheric influences. This is of the greater importance where bridge floors are of shallow construction, allowing greater deflection of beams even if the stresses in the same are not excessive. The deflection might cause cracks in the concrete encasing unless the latter is well reinforced with wire mesh or steel rods.

THE SHEKLETON NUTLOCK

The primitive nutlock was simply a second nut screwed down on top of the first. After this had proved itself ineffective, all sorts of devices appeared for the purpose of keeping the main holding nut tightly and permanently in place.

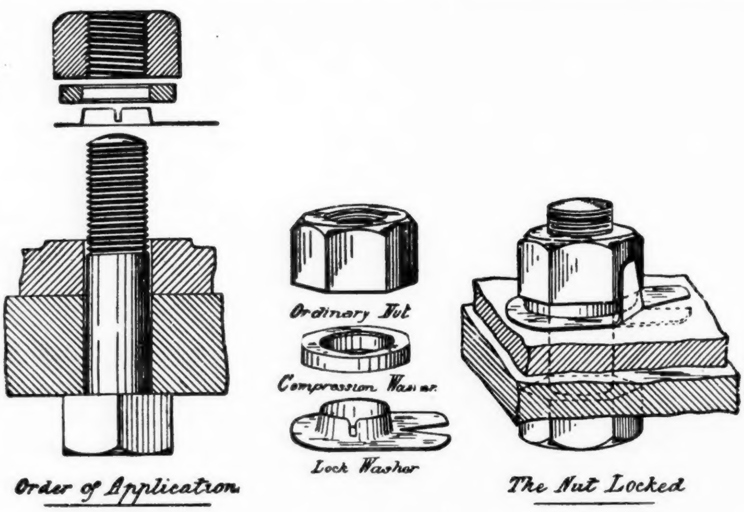
A very good one of these devices is manufactured by the Stanley Works, 100 Lafayette street, New York, N. Y. A nutlock presupposes a bolt and nut, and the Shekleton device merely adds two simple parts. One is a ring washer with two edges flattened enough to be caught by a wrench. It is called the compression washer. The other part is a very thin lock washer made to encircle the bolt. It has a "fish-tail" flap at one side, the use of which is apparent by a glance at our illustration. This washer is flat, and the fish-tail is flat, but the part that surrounds the nut has a raised, practically vertical, collar. This collar is tapered, being slightly smaller at the top, and is notched out or cut, so that the upstanding collar can be bent inwards on the threads of the bolt. The taper of the upright collar of the lock washer is exactly as you would expect to find it in any process of manufacture, but in this case the taper is put there purposely.

When the bolt is in place, the lock washer is slipped on the bolt, collar uppermost. Here let us say that the device shows its "fool-proof" quality, because if the slightly tapered collar of the lock washer was carelessly put on with upper edge down and washer under, the device would still be effective, as the collar would go down in the hole or bore of the compression washer; though "collar up," is the way it is intended to be used, and is the position that common sense would dictate.

When the lock washer is on the bolt, the compression washer is dropped over the collar of the lock washer, and the nut screwed down. The pressure of the nut on the compression washer pushes it down on the lock washer collar, and it begins to close in on the screw thread. The lock washer collar therefore bites in on the thread, and being thin and soft it roughly conforms to the thread, which it holds to, with great firmness. It must be mentioned that the collar of the lock washer is too short and too thin to duplicate, in itself, the thread of the bolt. If it did, it could be screwed on and off with the nut, but it does not form a full thread, it simply bites on the thread and holds. The fish-tail ends are then bent up on two adjacent sides of the nut, and the nut is locked.

To remove the nut, the fish-tail ends are flattened down as the lock washer is made of soft metal. The nut is then screwed off, and if the compression washer has become rusted or otherwise stuck to the lock washer, a tap from a hammer will loosen it, or failing that, the flat edges of the washer permit a turn or two by a wrench, and the washers can be removed by hand.

The biting in of the lock washer on the bolt thread is the principal thing in this device, because it does not form a duplicate thread and cannot be screwed on or off with the nut. The compression washer gives the necessary pressure to the collar of the lock washer, so as to make it bite the thread, and the nut supplies the force to accomplish the desired result. The nut therefore is the primary cause of its own locking.



Order of Application — *The Nut Locked*

RAIL LAYING ON THE KANKAKEE & URBANA

A device for laying steel rails has been invented by Mr. T. W. Shelton, General Superintendent of the Kankakee & Urbana Traction Company, which consists of an ordinary pair of freight car trucks on which is mounted a movable crane, having a movable jib; this jib extends a length of 20 ft., which enables a 33-ft. rail to be lifted out of an ordinary gondola car, swung around and laid

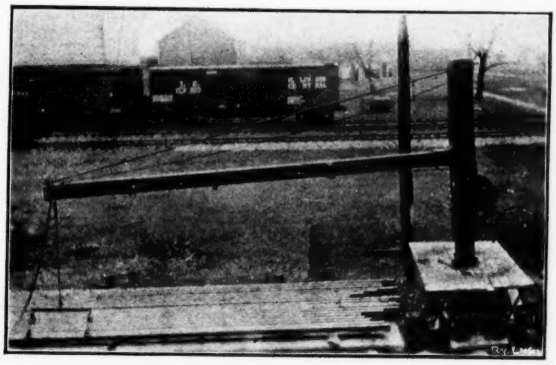
on the ties in its place. A crab is attached to the mast of the crane, which has a brake; this permits the rail to be lowered at will.

The device can be used for loading, unloading or relaying rails, and will unload, with the aid of only four men, one rail per minute or about a car load per hour.

For laying one-half to three-fourths miles of track per day two men are required at the crab, two men inside of rail car, one man to handle the line that swings the jib, two bolters, four spikers, two nippers, four end men for placing rail on ties, and one foreman; a total of eighteen men, whereas for laying the same amount of track in the old way it requires between forty and fifty men.

The rail-handling machine is coupled to the car load of rails in the ordinary way and is moved at will with the rail car.

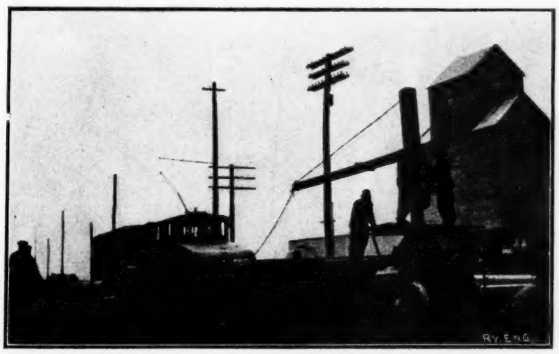
The entire construction train is composed of rail-handling device, one car load of rails, the electric engine,



Electric Train, K. & U. T., Laying Track.

a box car for carrying rail joints, bolts, spikes and all the necessary tools and one, two, or three car loads of ties.

The illustration represents the track-laying outfit. The weight of a rail is about 800 lbs., which, hanging on the end of a 20-ft. jib, requires a weight of about five tons



Derrick for Track Layer, K. & U. T. Ry.

on the truck to hold it on the track. This weight is procured by loading the truck with pig-iron.

The cars of ties are not shown in the illustration, as they are left a short distance back of the train and are unloaded from the cars to wagons, then hauled ahead of the track-laying gang and placed on the grade.

As our bodies to be in health must be *generally* exercised, so our minds, to be in health, must be *generally* cultivated.—*The Two Paths.*

PERSONAL ITEMS FOR RAILROAD MEN

Frank R. Judd has recently been appointed engineer of buildings for the Ill. Central R. R. with headquarters at Chicago.

D. C. Cage, recently appointed acting roadmaster for the Kansas City, Mexico and Orient railway, with headquarters at San Angelo, Texas, succeeds R. S. Baxter, resigned.

Curtis C. Westfall has recently been appointed engineer of purchases on the Illinois Central R. R. with headquarters at Chicago, succeeding Maro Johnson, who has been assigned to special work.

J. M. Garner, recently appointed superintendent of track of the Ill .Central R. R. at Carbondale, has been with that road for the past 30 years, serving in the capacity of supervisor and assistant roadmaster on the Tenn., Memphis and Illinois Divisions.

A. A. McCree, recently appointed roadmaster of the Northern Pacific Railway at Tacoma, Washington, was, previous to that appointment engineer in charge of construction on that road. He succeeds there T. Ellis, who has taken the place of John Finnell, deceased.

B. E. Sheffer, recently appointed trainmaster on the Southern Division of the C. G. W. Railway, has been in the employ of that road since 1896, and in 1908 was appointed road foreman of engines between Chicago and Oelwein. He succeeds C. Fowler, who has resigned from the service.

D. H. Thrasher, recently appointed division storekeeper of the St. L. and S. F. at Sapulpa, Okla., has been in the store department of that road at Springfield, Mo., for the past 11 years, serving as accountant, general stock clerk and chief clerk. His predecessor, A. B. Milby, has left the railroad to accept service with the German-American Car Co., at Sand Springs, Okla.

I. B. Pelot, recently appointed assistant trainmaster of the Norfolk and Western Ry., with headquarters at Crewe, where he succeeded C. D. Shamate, assigned to other territory on the same division, has been in the service of the Norfolk and Western R. R. since 1897, where he has filled all positions from yard brakeman to assistant trainmaster. Previous to that time Mr. Pelot was employed by the East Tenn. Va., and Ga. R. R. between Chattanooga and Atlanta.

Leigh M. Borden, recently appointed master carpenter on the Rochester division of the Erie R. R., has been in the employ of the Erie for 20 years, starting as messenger boy in the station at Arnot, Pa., and working as carpenter and boss carpenter in Arnot until, in 1911, he was appointed foreman carpenter on the Tioga division of the Erie at Blosburg, Pa., where he remained until his recent promotion. Mr. Borden succeeds on the Rochester division Frank Gelman, resigned.

W. J. Ahern, recently appointed general foreman on the Chesapeake & Ohio at Newport News, Va., where he succeeds Mr. Foizey, recently promoted to assistant master mechanic with headquarters at Newport News, entered the service in 1903 as roundhouse foreman and held that position for 7 years. He was then made shop foreman for 2 years and promoted to assistant general foreman, which position he has held for about 2½ years previous to the announcement of his recent promotion.

W. W. Eldridge, recently appointed storekeeper at Havelock, Neb., on the C. B. & Q. R. R., entered railroad service in 1900 as stenographer in the general office

building at Omaha. In October, 1905, he was promoted to chief clerk in the store house at Sheridan, Wyoming, and in 1906 was made assistant superintendent of the timber trading plant. In 1910 he was made general piece-work inspector under the general storekeeper at Chicago and held this position until his recent appointment at Havelock.

Mr. A. J. Hines has been appointed Engineer of Grade Crossing Elimination of the N. Y. C. & St. L. R. R. and the Department of Grade Crossing Elimination is restored. The limits of the Department will include the territory between East Switch, C., C., C. & St. L. transfer and New York Central overhead crossing, Cleveland. The ordinary care of track will continue to be in charge of the Superintendent of Track Maintenance and Construction.

J. W. Foizey, recently appointed assistant master mechanic for the Chesapeake & Ohio Railway at Newport News, Va., has been in the service of that road for the past 40 years. Mr. Foizey entered the service of the road at Richmond in 1875 as machinist and in 1889 was made gang foreman. In 1891 he was appointed general foreman at Newport News and in 1902 was transferred to Clifton Forge. In 1914 he returned to Newport News, where he remained until the announcement of his recent promotion.

C. E. Beeth, recently appointed superintendent of the Eastern Division of the El Paso and Southwestern Railway, with headquarters at Tucumcari, New Mexico, succeeds L. I. Morris, appointed general superintendent, with headquarters at El Paso, Texas, entered the service of the Santa Fe at 16 years of age, and served as telegraph operator, agent, train dispatcher and chief dispatcher with that road until 1908. In 1909 he was appointed trainmaster of the El Paso and Southwestern and held that office until the announcement of his recent appointment.

J. F. Rothschild, recently appointed Pacific Coast lumber agent for the purchasing department of the Chicago, Burlington & Quincy, at Seattle, Wash. He succeeds there J. E. Mathews, deceased. Mr. Rothschild entered the stores department of the C. B. & Q. in 1902, and in 1908 was appointed storekeeper at St. Joseph, Mo. In 1909 he was transferred to Hannibal and in 1911 was appointed chief lumber inspector at Chicago. He was made storekeeper at Galesburg and the Havelock in 1914 where he remained until the announcement of his recent change.

R. G. Edwards, recently appointed assistant superintendent of district No. 2 Montreal Terminals of the Canadian Pacific, entered the service of that road in 1900 at Smith's Falls, as call boy. In 1901 he was made car checker and in 1902 yard office clerk. In 1904 he became chief clerk in the yard office and in 1906 was transferred to the yard where a year later he was made yard foreman. In 1908 he was appointed night yard master, and in 1909 chief yard master, which position he held until the announcement of his recent appointment. Mr. Melrose, whom he succeeds at Montreal, has served there for 26 years as yard master, general yard master and assistant superintendent.

Z. T. Brantner, superintendent of maintenance of way shops on the Baltimore and Ohio R. R. at Martinsburg, W. Va., entered the service of the B. & O. in 1863 as water boy in the maintenance of way department. In 1864 he was appointed car oiler and in 1865 machinist's apprentice. In 1870 he was made gang foreman and in 1874 round-house foreman at Sandy Hook, Maryland. In 1886 he was made general foreman at Bay View and in 1891 he was transferred to Brunswick, Md. In 1905 he was appointed general foreman of maintenance of way shops, Martinsburg, W. Va., and in 1912 he completed 50 years of continued service with that road and was presented with a gold medal.

Irwin Ashton Seiders, recently appointed superintendent of motive power and rolling equipment of the Philadelphia & Reading Railway at Reading, Pa., succeeds S. G. Thomson, who has recently resigned. Mr. Seiders entered railroad service in 1882 as a laborer with that road and has been continuously in their employ. In 1882 he was made machinist's helper and in 1883 station hand. In 1887 brakeman and in 1888 he started as fireman. In 1890 he was promoted to locomotive engine man, in 1895 he was given extra passenger runs and in 1901 became a regular passenger engineman. In 1907 he was appointed road foreman of engines and in 1914 he was made fuel inspector, which position he held until the announcement of his recent appointment.

H. MacLaren, recently appointed division engineer of the Toronto district of the Canadian Northern Railway at North Bay, Ontario, served from 1896 to 1899 with McBride and Farncomb on general engineering work, including the location of the Spring Bank Electric Railway. In 1900 he was made resident engineer of construction of the L. E. & D. R. from St. Thomas to Walkerville and in 1902 resident engineer on construction of the H. & S. W. Railway. In 1904 he was appointed division engineer on the same work. In 1907 he was appointed division engineer of the Canadian Northern on the Garneau-Quebec line. In 1909 he held the same position on the Toronto-Ottawa line, and in 1911 in the North Bay district, which position he held until the announcement of his recent change. He succeeds in the Toronto district, J. D. Evans, transferred.

W. A. Cowan, recently appointed division engineer of the Canadian Northern Railways at Cochrane, Ont., entered the service of the C. P. Railway at London, Ont., in 1904, after having had three years' previous experience in bridge building on the C. P. R. before graduating as civil engineer from Toronto University. In 1905 he was made assistant engineer of terminals at Toronto, and from that time until 1911 he was resident engineer for that company, successively in Toronto, London, Ont., Farnham, Que. In 1911 he was made assistant engineer at Montreal, in 1912 superintendent at Brownville Junction and in 1914 resident engineer of construction of the Halifax Ocean Terminals. In 1914 he was later appionted resident engineer of the Canadian Northern Railway at Truro and held that position until his recent appointment as division engineer of the National Transcontinental Railway.